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SANTA CLARA VALLEY WATER DISTRICT

PALO ALTO FLOOD BASIN HYDRAULIC METHODOLOGY

S-6

Prepared
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APRIL 1986

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PREFACE

This report is a documentation of the Santa Clara Valley Water District's hydraulic routing of storm runoff from Adobe, Barron and Matadero Creeks through the Palo Alto Flood Basin into San Francisco Bay. The District used the computer program "Flood", which was written in the early 1970's to analyze the routing. This report supplements two Water District reports, one written in 1976 entitled, "Hydrology Documentation for Northwest Flood Control Zone" (1) and another written in 1984 entitled, "Palo Alto Flood Basin Hydrology, Comments on City of Palo Alto's Independent Study". (2) Since the primary function of this report is to document the hydraulic analysis that the District used to determine how the water accumulates and leaves the basin, it does not address the hydrologic analysis that was used to determine the design inflow to the basin.

The Palo Alto Flood Basin drains into San Francisco Bay by gravity through fifteen five by five-foot District tide gates and one City of Palo Alto sluice gate located at the north end of the basin (see Figure 1). The basin will drain when the elevation of the water in the basin is higher than the water in the Bay. The gates do not allow saltwater to flow back into the basin, with the exception that the City gate does allow this backflow for salt marsh management purposes when the elevation of the water in the basin is below -2.0 feet NGVD (NGVD - National Geodetic Vertical Datum). For this reason, the flood basin model assumes no available flood control storage below elevation -2.0 feet NGVD.

The basin is modeled as a detention basin that stores floodwaters until the tides are low enough to discharge into San Francisco Bay.

The desired end result of the analysis is to determine the maximum water surface elevation in the basin that can be expected from a 1% flood. This elevation is needed to design the height of the levees necessary to store the storm waters.

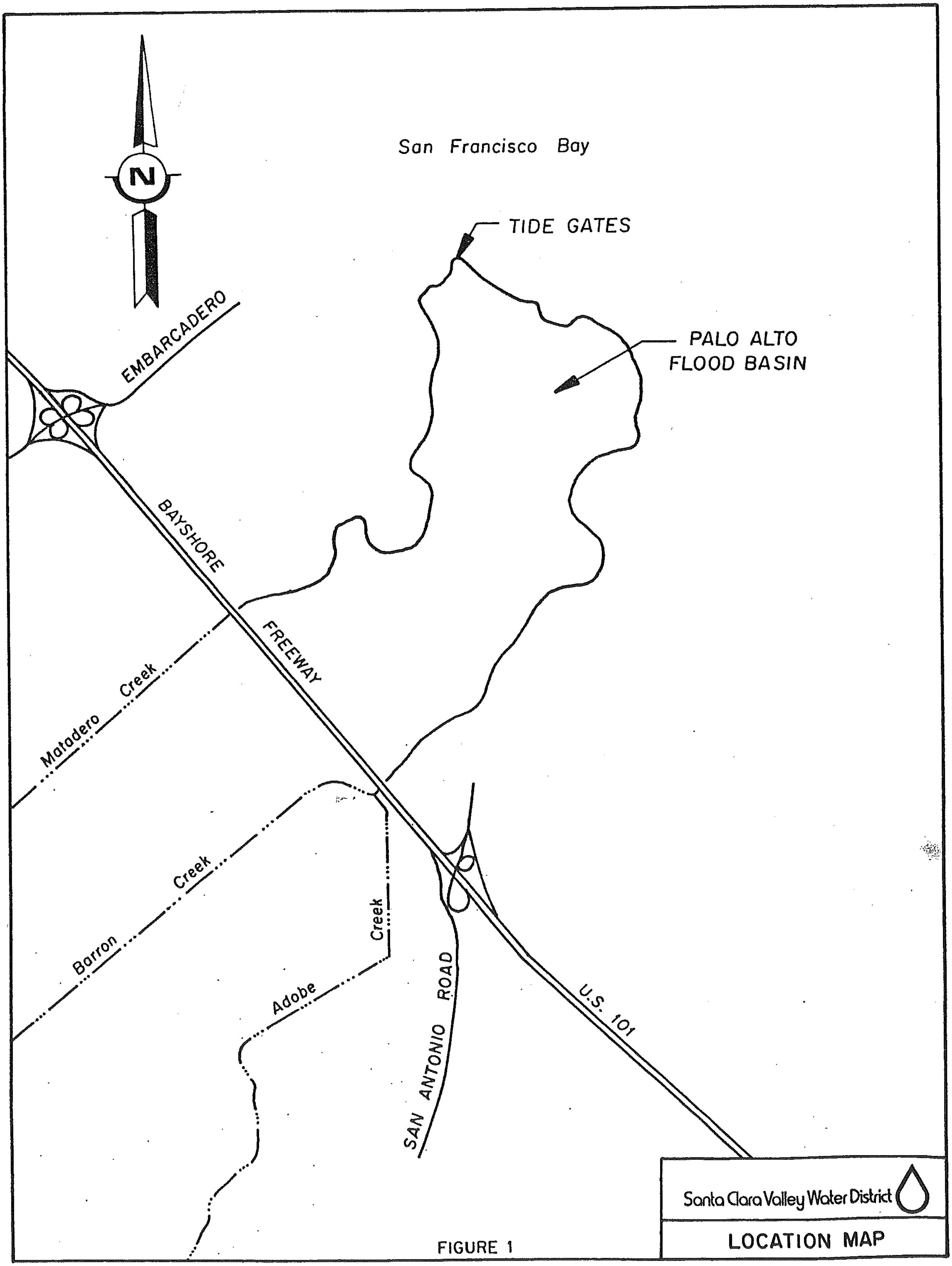

N
San Francisco Bay
TIDE GATES
PALO ALTO FLOOD BASIN
EMBARCADERO
BAYSHORE
FREEWAY
U.S. 101
Matadero Creek
Barron Creek
Adobe Creek
Creek
SAN ANTONIO ROAD
Santa Clara Valley Water District
LOCATION MAP

FIGURE 1

In this report, the hydraulic assumptions used by the District are compared in some cases to those used by the City of Palo Alto's consultant, Linsley, Kraeger Associates who performed an independent hydraulic analysis of the basin.

Since the report contains technical hydraulic terms with which the reader may not be familiar, a glossary of such terms may be found at the end of the report.

The production of this report required the services and contributions of several staff members within the District. Major contributions to the model description were provided by Mrs. Jeanette Micko. Assembly and a comprehensive review of the data and text were provided by Abdullah Saah, Bill Hoeft, and Scott Theis.

MODEL DESCRIPTION

Introduction

A computation of the water surface elevation in the basin is based on the assumption that the change in storage over a certain time interval is equal to the inflow (flow into the basin) minus the outflow (flow out of the basin). Outflow from the basin through a tide gate structure is not constant but is dependent upon water surface elevations in the basin and tidal elevations outside of the tide gates.

Program Input

It is necessary to input certain basin characteristics and other information that will control how the program computes water surface elevations in the basin. Specifically, these inputs are - the tide cycle within San Francisco Bay in feet of elevation; the inflow hydrograph representing storm flows from Adobe, Barron, and Matadero Creeks in cubic feet per second; the storage elevation curve that describes the basin capacity with the volumetric storage in acre-feet versus the basin elevation in feet; the discharge coefficients which describe the flow through the gates; the initial basin storage along with its associated elevation. A sample of the necessary input is found in Appendix III.

Computation of Basin Elevation

The computation of the basin water surface elevation is based on the formula: $dS/dt = I - O$. This equation stated that the change in storage (dS) during an incremental time element (dt) is equal to the inflow rate minus the outflow rate. In this case, dS/dt is the change in storage over a differential time element, I is the inflow provided by the inflow hydrograph and O is the outflow. The numerical solution method used starts the calculations of basin water surface elevation and the predictor-corrector method is used to continue the calculations for a better fit to the real value. A detailed description of the numerical solution method is enclosed in Appendix I.

The outflow from the basin, O, is modeled as either weir flow or orifice flow depending upon the water surface elevation in the basin. To determine if the tide elevation influences the quantity of outflow leaving the basin, a test for submergence is included in the program. There are times when the tide elevation is low enough not to influence the outflow. Appendix II contains a detailed description of the methodology the program uses in computing the outflow, O.

Program Output

Program output lists all the input values and tabulates the time in hours, inflow (cubic feet per second), outflow (cubic feet per second), storage (acre-feet), basin elevation (feet), and tidal elevation (feet). The maximum basin elevation for each run, of a particular tide and inflow combination, is found in the column entitled "Basin Elevation". Appendix III also includes a sample of the output.

(A) Type 1 - Lower high water followed in order by lower low water, higher high water and higher low water (LH-LL-HH-HL) and;

(B) Type 2 - Lower high water followed in order by higher low water, higher high water, and lower low water (LH-HL-HH-LL). (6)

Both ascending and descending series of higher high water tide cycles occur during each month with almost equal frequency. The higher high water will ascend to higher elevations in a series of tide cycles until a high point is reached. At this point, the higher high water begins to descend in each following tide cycle in the series. Refer to Figure 2 for a sketch of these various patterns, cycles and sequences.

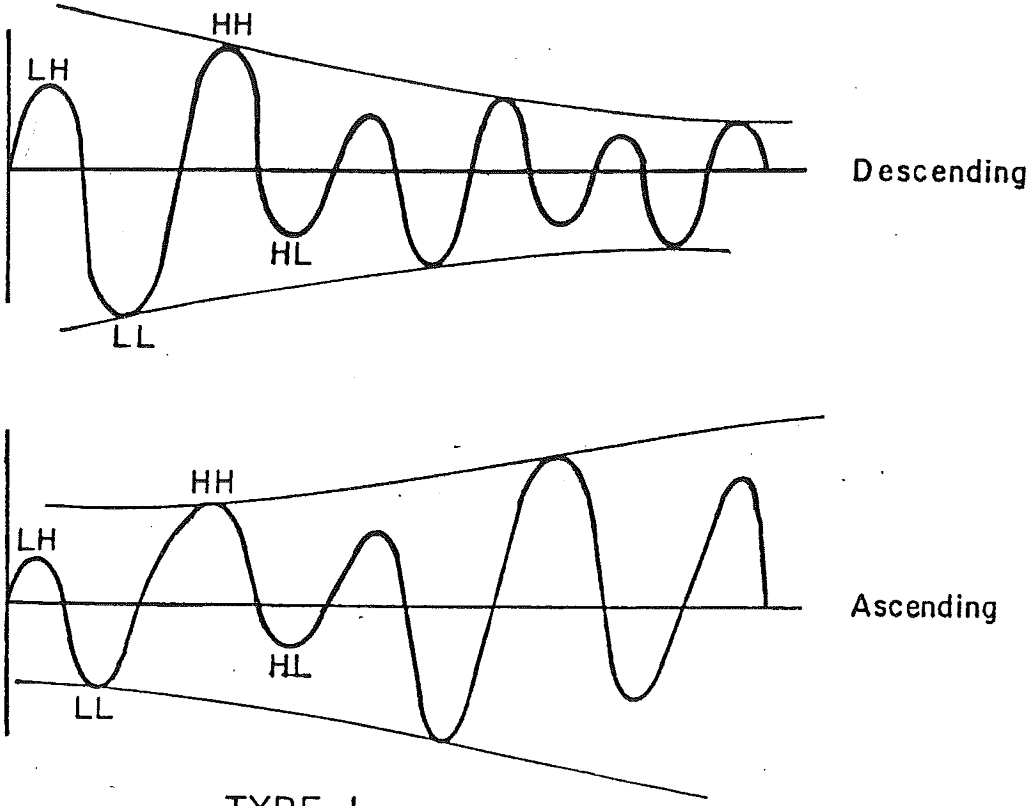
The District arbitrarily chose to use a descending tide sequence and Type 1 pattern.

Timing of the Tide Cycle

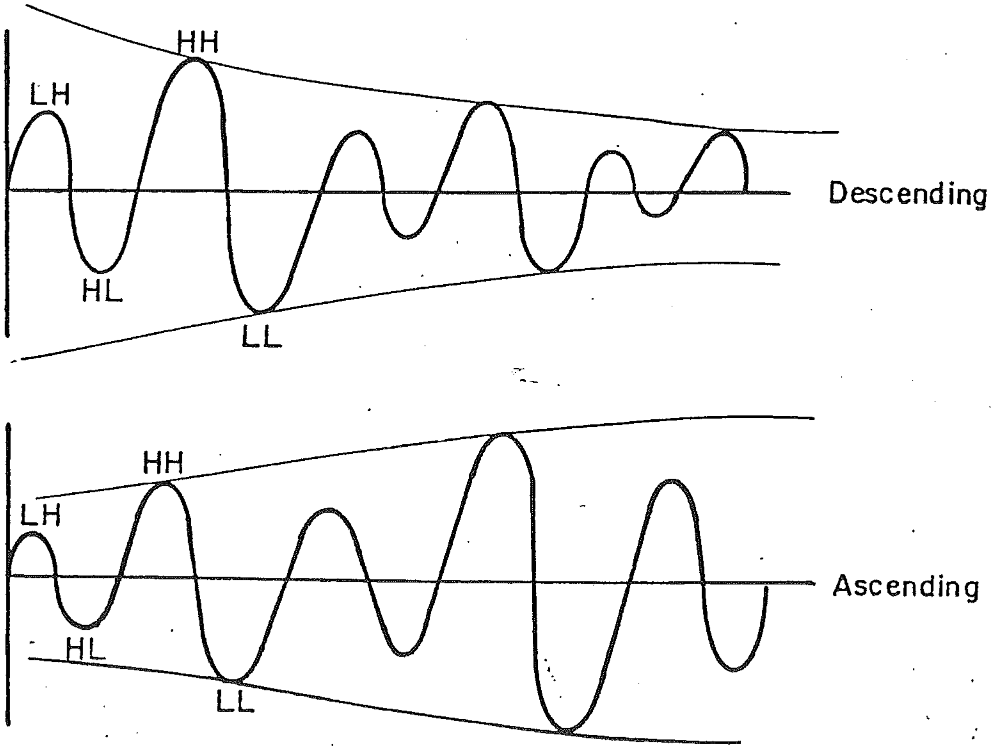
The third and final aspect that must be addressed relative to tide is the point within the tide cycle that the flood basin inflow hydrograph starts. In the District's model for a given tidal cycle and inflow hydrograph, it is possible to generate different basin elevations depending on when the inflow hydrograph begins in the tide cycle. The District has chosen as its design water surface elevation the maximum basin elevation that results from the 75 separate computer model runs which begin the inflow hydrograph at 75 successive hourly points within the tide cycle sequence. This is accomplished by shifting the tidal sequence which results in varying the starting time of the inflow hydrograph in one hour intervals and producing 75 different routings through the basin. The range in resulting basin elevation varies from a maximum of 5.7 feet NGVD to a minimum of approximately 4.0 feet NGVD (see Appendix D , Figure A).

Discussion

In examining the District's model through a series of sensitivity analyses, one question we have attempted to answer is how much variations in the sequence and the pattern of the tides will affect the maximum water surface expected in the basin.



TYPE 1



TYPE 2

TIDAL PATTERNS, CYCLES AND SEQUENCES

(NOT TO SCALE)

FIGURE 2

The results of the District's sensitivity analyses related to this point are shown in Figures B and C in Appendix D and F. In general, the model is not sensitive to a change in the tide pattern and sequence.

Discharge Coefficients

The District has chosen to model the gated structure by using a different discharge coefficient for each of two possible cases of outflow.

The first outflow condition is when the outflow does not fill the entire gate opening. In this case, the flow is modeled as weir flow with a discharge coefficient equal to 2.90. The District's value of 2.90 is approximately at the midpoint of a range of values (2.34 - 3.32) provided in King's "Handbook of Hydraulics" (Table 5-3) (7) for broadcrested weirs. The District chose to use 2.90 in its determination of a design water surface elevation and then check its effect by varying it in a sensitivity analysis. The effect on the final design water surface was found to be negligible in the sensitivity analysis, refer to Appendix F.

The other case that is modeled exists when the outflow occupies the entire gate opening. In this case, the outflow is computed using an orifice coefficient of 0.5 for the value of C in the equation $Q = CA\sqrt{gH}$.

Partial justification of an orifice coefficient equal to 0.5 is provided by Chow, 1959.(8) He states that the discharge coefficient varies from approximately 0.45 to 0.75 for a culvert that acts like an orifice. The orifice coefficient was also determined by using a computational procedure described in a publication entitled, "Design of Small Dams". (9) See Appendix E for this computation that results in an orifice discharge coefficient of 0.51. In both of the cases, an attempt was made to account for losses associated with the trashracks, gates, contractions and expansions.

Sensitivity analyses were performed on both the weir and the orifice coefficient. When the weir coefficient was decreased from 2.9 (the District's value) to 2.55 (an approximation of Linsley's value), the maximum water surface in the basin did not change (compare files IKTJK3 and IKTJK7 in Appendix F.). When the orifice coefficient is increased from the District's 0.5 to 0.8 (an approximation of Linsley's value), the maximum basin water surface elevation dropped 0.8 feet (compare files IKTJK3 AND IKTJK2 in Appendix F.).

ADDITIONAL SENSITIVITY ANALYSES

Introduction

The purpose of sensitivity analysis is to determine how sensitive the elevation of the water surface in the basin is to variations in certain parameters. The following analyses were done in addition to those already mentioned (see Appendix VI for a summary table of all sensitivity analyses).

Inflow Hydrograph

When the inflow hydrograph's peak is reduce from 6,992 cfs (District's peak) to 5,468 cfs (Linsley's peak value) and all other inflow values are reduced proportionally, the maximum water surface in the basin decreases approximately 0.8 feet when routed through the District's model (refer to Appendix IV, Figure C, for a graphical representation of this analysis).

Orifice Coefficient

As mentioned in a previous section entitled "Discharge Coefficients", the maximum basin elevation decreases up to 0.8 feet when the orifice discharge coefficient is raised from 0.5 to 0.8.

Starting Place in Tide Cycle

Depending upon where in the tide cycle the inflow hydrograph begins, the resulting basin elevation can vary up to 1.9 feet. This indicates that the timing of the storm relative to the tide cycle is critical in determining the resulting basin elevation.

Pattern and Sequence

Changing the tide pattern from LH-LL-HH-HL to LH-HL-HH-LL and simultaneously changing the sequence from a descending tide to an ascending tide resulted in a 0-4-foot increase in the water surface elevation in the basin. This result can be observed graphically by comparing the peak basin elevations plotted in Appendix IV, Figures A and B.

GLOSSARY OF TERMS

Discharge Coefficient - (C) used to compute amount of flow leaving the basin. Used in these equations: $Qw = CH^{3/2}$; $Qo = CA\ (2gH)^{1/2}$.

Hydrograph - a plot of streamflow versus time.

Hydrologic - of or relating to hydrology.

Hydrology - the study of water on the surface of the land, in the soil and underlying rocks, and in the atmosphere, particularly with respect to evaporation and precipitation.

Hydraulics - a branch of science that deals with practical applications of water or other liquids in motion.

Loss Coefficient - (K) used to compute minor losses. Used in this equation: $K\ (V^2/2g)$.

NGVD - National Geodetic Vertical Datum.

Orifice - opening with closed perimeter through which water flows.

Tide Cycle - one complete period of the reversal of high and low tides.

Tide Gate Structure - structure used to separate the tidal waters of the Bay from the basin.

Tide Pattern - particular succession of high and low tides within a tide cycle.

Tide Sequence - particular succession of tide cycles.

Wave Run-up - vertical distance above still water that a wave runs up the containment levee.

Wave Set up - tilting of the water surfae over an entire body of water.

Weir - a notch in a levee or other barrier to regulate the flow of water.

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9. Design of Small Dams, U. S. Bureau of Reclamation, 2d Ed., Washington, D. C., 1973.
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APPENDIX A

"NUMERICAL SOLUTION METHOD"

This program uses the Runge-Kutta method to start the calculations and the predictor-corrector method to check the calculations for a better fit to the real value. The equation to be solved is dS/dt = I - O where dS/dt is the change in volume over a differential time increment, I is the inflow and O is the outflow. A more complete discussion of the Runge-Kutta method may be found in "Numerical Methods with Fortran IV Case Studies". (12)

The initial conditions are given as a starting point. The basin is assumed empty. The initial value for the basin elevation is -2.00 feet NGVD which is the depth the basin is maintained during the winter setting of the Palo Alto tide gate. The available storage is zero. The given conditions are: initial time is equal to zero, t (0) = 0; initial storage is equal to zero, S (0) = 0.00; minimum storage equals 25.0 acre-feet, Smin = 25.0; time increment equals 0.10 hours, DELT = 0.10; epsilon equals 0.01, EPSIL = 0.01; printout time equals 1.0, POT = 1.0; maximum time of integration equals 100.0 hours, TMAX = 100.0; time of integration equals 24.0 hours, TN = 24.0; maximum number of iterations is 100, MAXIT = 100.

The computer solves the first-order Runge-Kutta equation (predictor) S (n+1) = S(n) + DELT* (I (n) -O (n))*0.082644. S (n+1) is the storage at time (n+1). S n is the storage at t n. DELT is the incremental time from t (n) to t (n+1) set at 0.1 hours in these studies. I (n) is the inflow at t(n). The factor 0.082644 converts the inflow and outflow from cubic feet per second to acre-feet of storage. This equation uses the information at the current point, t (n), to predict values for the next point, t (n+1). The basis for the Runge-Kutta method is that the computer determines the slope at the current point and extends that constant slope to the next point. Since the slope is not constant, the Runge-Kutta method introduces error. This method gives us the first guess of the next storage, S (n+1), value.

The corrector is the first-order equation for the predictor-corrector method. The predictor-corrector method requires knowledge of three points. It uses the computed values at t (n), the predicted values at t (n+1) determined by the Runge-Kutta method or the previous predictor-corrector calculation, and the corrected values at t (n+1) determined by the corrector equation. The corrector equation is S (m+1) (n+1) = S (n) + (DELT/2) * (I (n) - O (n) + I (m) (n+1) - O (m) (n+1))* 0.082644. S (m+1) (n+1) is the (m+1) approximation of the next storage (S (n+1)) value at t (n+1). S (n) is the already computed storage at t (n). DELT is the time increment of 0.1 hours. I (n) is the computed value of the inflow at t (n); O (n) is the computer outflow at t (n); I (m) (n+1) is the predicted inflow at t (n+1); O(m) (n+1) is the predicted outflow at time t (n+1); and the constant 0.082644 changes the flow rates to storage in acre-feet. The variable m is the ITER or iteration counter set at a maximum of 100 as an input variable for the predictor-corrector method. Everytime the error criteria are not satisfied, the m counter adds one. The corrector value S(m+1) (n+1) becomes the predictor value S(m) (n+1) until the error criteria are met or the number of iterations exceeds the input value for ITER.

Note that the corrector equation averages the values at time t (n) and t (n+1). The mathematical basis is that the slopes at both points are averaged so the incremental time element is multiplied by the average of the inflow minus the outflow for the two times. In determining the area under a curve, the average of the y-values (the inflow minus the outflow) is multiplied by the incremental x-value (the incremental time). The repetitive process reduces the error. The process cannot begin with the Runge-Kutta equation.

The error criterion, EPSIL, is used to compare the last two values, the predicted and corrected values, both at time t (n+1). If the Runge-Kutta equation (the predictor) is within the error limitation of the corrector, the program uses the corrected value as the computed storage, (S (n+1), value. If however, there is too much error, the program uses the corrected value as the predicted value and tries again.

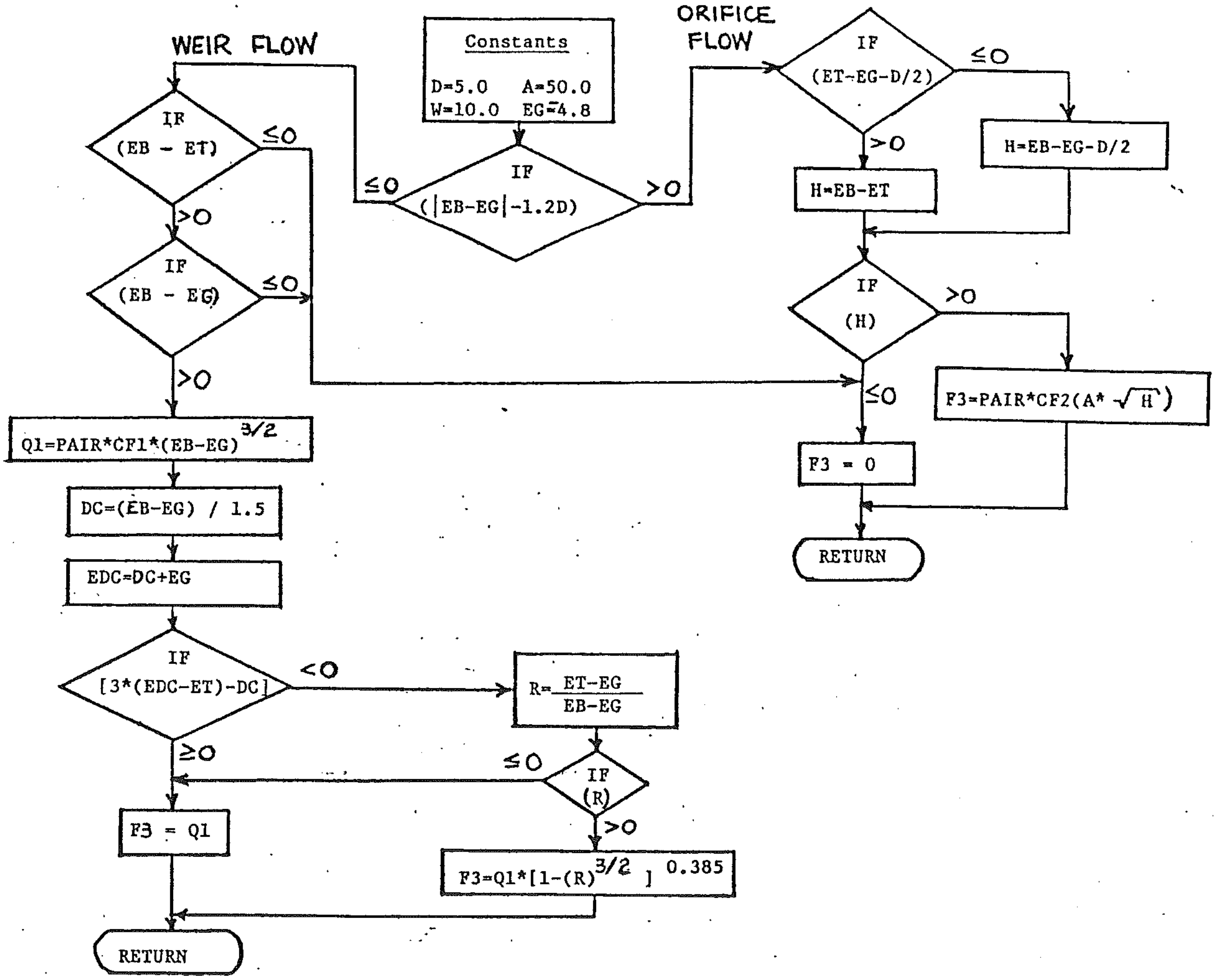
Since the storage values are not constant but increasing during the flood time, the error is limited by comparing the difference between the predicted and corrected values of storage and dividing by the corrected value of storage: (Absolute value (S (m+1) (n+1) - S(m) (n+1))/Absolute value (S(m+1) (n+1))) $<$ EPSIL. The value of EPSIL used in this program is .01. This means that the allowable difference between the predicted and corrected values is less than 0.01 times 4,610 acre-feet (the value at elevation 7.00 feet NGVD) or 46 acre-feet which is at a water surface elevation in the basin of 0.08 feet NGVD. The maximum error in the predictor-corrector is less than approximately plus or minus 0.1 feet.

APPENDIX B

"COMPUTATION OF OUTFLOW"

Outflow from the basin is modeled as either weir flow or orifice flow depending upon the basin's water surface elevation. Figure 4, on the next page, is a flow chart that describes the numerical steps taken by the program to compute the outflow, O, through the gated structure. The critical elevation in the basin that determines whether the flow will be modeled as weir or orifice flow occurs when the depth of water above the gate invert is 1.2 times the height of the gates.(8) In the case of the Palo Alto Flood Basin, the invert of the gates is at an elevation of -4.8 feet NGVD and the gates are five feet tall, resulting in a basin water surface elevation of 1.2 feet NGVD. Basin elevations equal to or below 1.2 feet NGVD are modeled as orifice flows. In either case, if the elevation of the basin is less than or equal to the elevation of the tides, (If $(EB - ET) \leq 0$), the tide gates are closed and the outflow is zero ($F3 = 0$). Also, if the elevation of the basin is less than or equal to the invert elevation of the tide gates (If $(EB - 4.80 \leq 0)$, the outflow is again zero. The following paragraphs will discuss the computational procedure for weir flow and orifice flow, respectively.

For basin elevations below 1.2 feet NGVD, the weir flow equation, $Q = (PAIR)(CF1)(W)(EB - EG)^{3/2}$, is used to compute the discharge from the basin. In this equation, PAIR refers to the number of pairs of gates, CF1 refers to the weir coefficient chosen (in our case, 2.90), and W refers to the width per pair of gates (in our case, 10 feet). The District assumes that the flow will be exiting through all 15 gates plus the sluice gate, which is treated as if it were a flap gate. The variables EB and EG refer to the basin elevation and gate elevation respectively. The flow chart continues from here by checking for submerged flow. To qualify for submerged flow, the submergence must be greater than two-thirds of the upstream head. First, the submerged flow depth is equal to two-thirds of the upstream head of the weir $DC = (EB - EG)/1.5$, where DC is



Flow Chart for Function F3 (EB,ET,CF1,CF2,PAIR)

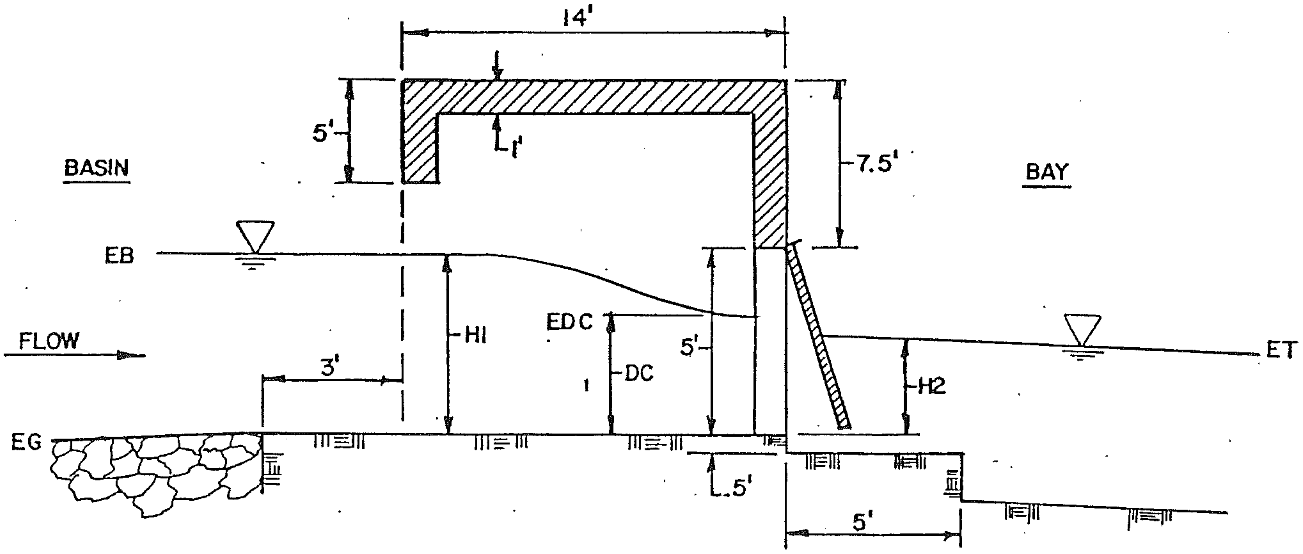
FIGURE 4

the submerged flow depth). Refer to Figure 5 on the next page for a description of the variables involved. The elevation of the submerged depth is the submerged depth plus the elevation of the invert of the tide gates (EDC = DC + EG, where EDC is the elevation of the submerged depth). Now that the depth of submergence has been determined, the difference between the elevation of the tide and the submerged depth elevation is compared to the submerged depth. The test is written: IF $3 \times (EDC - ET) - DC < 0$, the weir is submerged. For submerged flow, the equation is: $Q/Q1 = (1 - (H2/H1)^{1.5})^{0.385}$ (P.5-19, Kings Handbook of Hydraulics).(7) The value of Q has to be determined. Q1 is the free flow value.

The program assigns the variable R to H2/H1, which is the head on the weir (or the invert of the tide gate) on the downstream (bay) side of the gate divided by the head above the weir on the upstream (basin) side of the gate. The program also checks R to make sure that R is greater than 0, because negative values could occur when the tide is lower than the invert of the tide gates. A negative value would increase the flow and the submerged flow should be less than the free flow. If R is less than or equal to zero, the outflow will revert to the free flow condition which has already been determined. If R is greater than zero, the free flow outflow (Q1) is reduced; the resulting equation is $Q = Q1 (1 - (R)^{1.5})^{0.385}$.

Once again referring to the flow chart, Figure 4, the orifice flow check is satisfied when the elevation of the basin is greater than 1.2 feet NGVD. The difference in head between the upstream side of th tide gates and the downstream side of the tide gates is the next check within the flow chart. For orifice flow from a reservoir, the head (in this case, the head on the basin or upstream side) is measured to the midpoint of the opening (in this case, the midpoint of the tide gates). The velocity in the reservoir upstream of the tide gates is assumed zero.

There are two possible conditions, the tide can be higher or lower than the midpoint of the tidegates. If the tide is higher than the midpoint of the tide gate (higher



CROSS SECTION OF GATE STRUCTURE

FIGURE 5

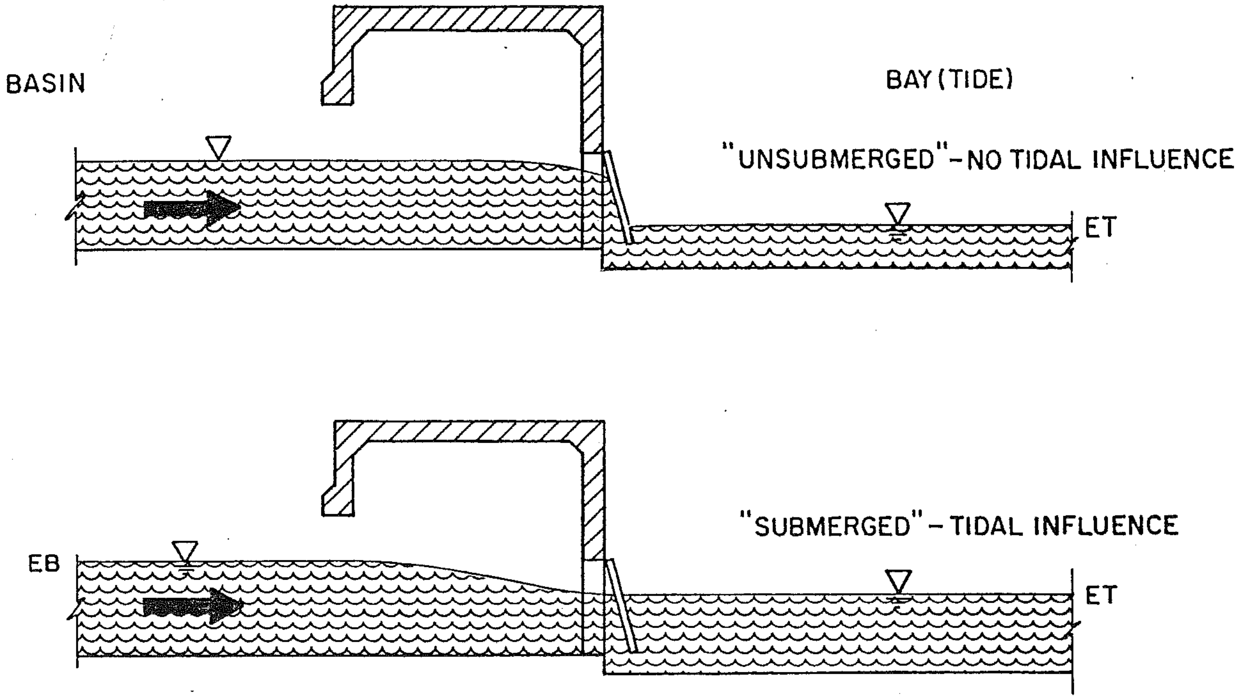
Not To Scale

than -2.30 feet (NGVD), the equation (ET - EG - D/2) is positive and the head difference between the upstream of the tide gates and the downstream of the tide gates is the difference between the elevation inside and outside of the basin. ET is the tidal elevation. EG is the invert elevation of the tide gates. D is the height of the tide gates. This is simply the difference between Z1 and Z2 in the Bernoulli equation. This satisfies the condition of submerged flow, refer to Figure 6.

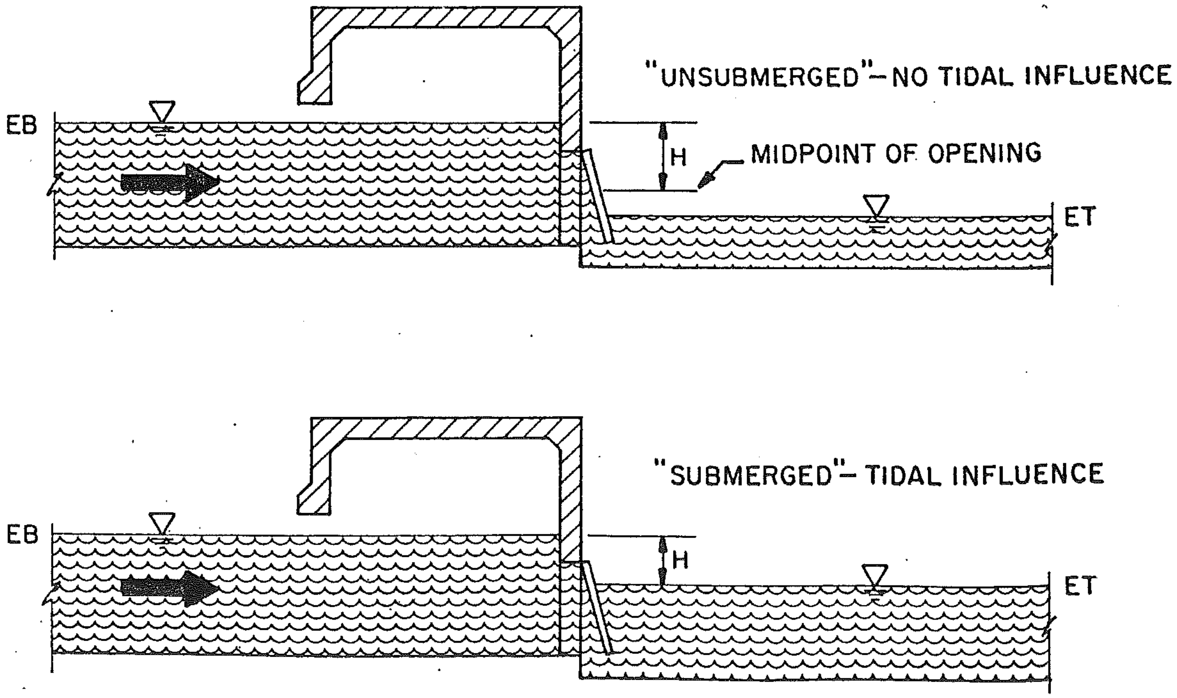
The other condition is if the tide is lower than the midpoint of the tide gate (lower than -2.30 feet NGVD). This is free flow and the head is the difference between the reservoir elevation and the midpoint of the orifice (tide gate). In this case, the equation (ET - EG - D/2) is less than zero and the head is determined by the equation H = EB - EG - D/2.

In both cases, the head is checked to make sure that it is positive. A negative head would mean that water would be flowing into the basin, and the model is trying to compute the outflow. If the head is less than or equal or zero, the outflow is zero. The tide gates are closed, and no water can exit. The basin continues to fill if the inflow hydrograph is not zero. If the head is greater than zero, the outflow is expressed by the equation $F3 = (PAIR)(CF2)(4)(H)^{0.5}$. H is determined by the previous equations; the area of the two tide gates is given, and the number of pairs of tide gates is given. The dimensions of each tide gate are 5.0 feet by 5.0 feet, resulting in a 50.0 square foot area for each pair of gates. The orifice flow equation is commonly written as: $Q = CA (2gH)^{1/2}$. In this computer model, the constant CF2 represents $C(2g)^{1/2}$, where C is an orifice discharge coefficient and g is the accerleration due to gravity.

WEIR FLOW


BASIN
BAY (TIDE)
"UNSUBMERGED" - NO TIDAL INFLUENCE
ET
EB
"SUBMERGED" - TIDAL INFLUENCE
ET

ORIFICE FLOW


"UNSUBMERGED"– NO TIDAL INFLUENCE
EB
H
MIDPOINT OF OPENING
ET
"SUBMERGED"– TIDAL INFLUENCE
EB
H
ET

WEIR AND ORIFICE FLOW

FIGURE 6

APPENDIX C
"INPUT/OUTPUT"
SAMPLE INPUT FORMAT

IBM FORTRAN Coding Form

GX28-7327-6 U/M 050**
Printed in U.S.A.

PROGRAM	SAMPLE "FLOOD" INPUT FORMAT	PUNCHING INSTRUCTIONS	GRAPHIC
PROGRAMMER	JIM HOUSTON	DATE 10/31/84	PUNCH

PAGE OF

CARD ELECTRO NUMBER*

```
TITLE
DC03            (100 YEAR INFLOW)
CONSTANTS
       0.1      0.01        1.      100.       24.      100.
INITIAL C
       0.0      290.      285.
FLOW COEFF
      2.90      4.01         8
F1 TABLE -   26 POINTS
      15.0     -4.80
        ↓         ↓
F2 TABLE -   76 POINTS,REPEAT  CYCLE    1 TIMES
       0.0      0.00
       1.0     -1.20
        ↓         ↓
F4 TABLE -   78 POINTS
      0.00        76
      0.50       147
        ↓         ↓
BSHIFT F2   1.0 HOUR
       1.0     -1.20
        ↓         ↓
CALCULATE
ENDJOB
```

*A standard card form, IBM electro 888157, is available for punching statements from this form

**Number of forms per pad may vary slightly

INPUT VARIABLES

CONSTANTS

0.1 = DELT = Time increment.

0.01 = EPC1L = Error Criterion.

100 = TMAX = Maximum number of hours the program runs unless stopped by other limitations.

24 = TN = Time of integration which is approximately the length of the storm.

100 = MAXIT = Maximum number of interactions used to calculate the differential equation.

INITIAL

0.0 = TZERO = Starting time.

290.0 = SZERO = Starting basin storage (changed to 0.0 in Study No. IUC2).

285.0 = SMIN = Minimum storage when the program can end.

FLOW COEFF

2.9 = CF1 = Composite weir flow coefficient.

4.01 = CF2 = Composite orifice flow coefficient.

F1 TABLE: Storage - Elevation Table

26 = Total number of pairs in F1 Table

15.0 = Storage in acre-feet.

-4.80 = Elevation in feet.

F2 TABLE: Tide Cycle

76 = Total number of pairs in one tide cycle.

1 = Number of time tide cycle is repeated (changes to four in Study No. 1002).

0.0 = Time in hours.

0.00 = Tidal elevation in feet.

F4 TABLE: Inflow Hydrograph

78 = Total number of pairs in F4 Table.

0.0 = Time in hours.

0 = Inflow in cubic feet per second.

B SHIFT F2

1.0 = Number of hours the tide cycle is shifted from the current tide cycle.

1.0 = Number of hours shifted.

-1.20 = Tidal elevation at the new starting point.

NOTE: The input variables must be entered as shown within the format limitations as indicated by the program listing.

INPUT DATA FILE

```
*********************************************** E N G D A T   F I L E   L I S T I N G **********************************************
*      NUMBER           FILE                                                                             RUN           PAGE        *
*      RECORDS          NAME                                                                             DATE          NO          *
*       572             IKJTK2                                                                           10/16/84         1        *
************************************************************************************************************************************
*                                                                                                          1         1         1   *
*                1         2         3         4         5         6         7         8         9         0         1         2   *
*       123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890   *
*                                                                                                                                  *
*    1  TITLE                                                                   TI-0000                                            *
*    2  ..WD          WATER DISTRICT STUDY                                                                                         *
*    3  CONSTANTS                                                               CO-0000                                            *
*    4         0.1      0.01        1.      100.       24.       100             CO-0001                                            *
*    5  INITIAL C                                                               IN-0000                                            *
*    6         0.0      290.     285.0                                                                                             *
*    7  FLOW COEFF                                                              FL-0000                                            *
*    8        2.90      4.01         8                                                                                             *
*    9  F1 TABLE -   26 POINTS                                                  F1-0000                                            *
*   10        15.0     -4.80                                                     F1-0001                                            *
*   11        50.0     -4.30                                                     F1-0002                                            *
*   12        70.0     -4.00                                                     F1-0003                                            *
*   13       100.0     -3.50                                                     F1-0004                                            *
*   14       160.0     -3.00                                                     F1-0005                                            *
*   15       230.0     -2.50                                                     F1-0006                                            *
*   16       290.0     -2.00                                                     F1-0007                                            *
*   17       355.0     -1.70                                                     F1-0008                                            *
*   18       450.0     -1.40                                                     F1-0009                                            *
*   19       625.0     -1.00                                                     F1-0010                                            *
*   20       880.0     -0.50                                                     F1-0011                                            *
*   21      1140.0      0.00                                                     F1-0012                                            *
*   22      1410.0      0.50                                                     F1-0013                                            *
*   23      1655.0      1.00                                                     F1-0014                                            *
*   24      1935.0      1.50                                                     F1-0015                                            *
*   25      2220.0      2.00                                                     F1-0016                                            *
*   26      2475.0      2.50                                                     F1-0017                                            *
*   27      2755.0      3.00                                                     F1-0018                                            *
*   28      3025.0      3.50                                                     F1-0019                                            *
*   29      3265.0      4.00                                                     F1-0020                                            *
*   30      3545.0      4.50                                                     F1-0021                                            *
*   31      3800.0      5.00                                                     F1-0022                                            *
*   32      4095.0      5.50                                                     F1-0023                                            *
*   33      4350.0      6.00                                                     F1-0024                                            *
*   34      4635.0      6.50                                                     F1-0025                                            *
*   35      5000.0      7.00                                                                                                       *
*   36  F2 TABLE -   76 POINTS,REPEAT CYCLE    1 TIMES                                                                             *
*   37         0.0      0.00                                                                                                       *
*   38         1.0     -1.20                                                                                                       *
*   39         2.0     -1.07                                                                                                       *
*   40         3.0     -0.18                                                                                                       *
*   41         4.0      0.71                                                                                                       *
*   42         5.0      1.61                                                                                                       *
*   43         6.0      2.50                                                                                                       *
*   44         7.0      2.75                                                                                                       *
*   45         8.0      2.35                                                                                                       *
*                                                                                                                                  *
************************************************************************************************************************************
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INPUT

```
*********************************************** E N G D A T   F I L E   L I S T I N G ***********************************************
*      NUMBER            FILE                                                                             RUN           PAGE        *
*      RECORDS           NAME                                                                             DATE          NO          *
*        572             TKJTK2                                                                          10/16/84        2          *
*************************************************************************************************************************************
*                                                                                                          1         1         1    *
*                1         2         3         4         5         6         7         8         9         0         1         2    *
*       123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890    *
*                                                                                                                                   *
*   46         9.0      0.86                                                                                                        *
*   47        10.0     -0.63                                                                                                        *
*   48        11.0     -2.11                                                                                                        *
*   49        12.0     -3.60                                                                                                        *
*   50        13.0     -3.84                                                                                                        *
*   51        14.0     -3.50                                                                                                        *
*   52        15.0     -1.90                                                                                                        *
*   53        16.0     -0.30                                                                                                        *
*   54        17.0      1.30                                                                                                        *
*   55        18.0      2.90                                                                                                        *
*   56        19.0      4.10                                                                                                        *
*   57        20.0      4.55                                                                                                        *
*   58        21.0      4.58                                                                                                        *
*   59        22.0      4.30                                                                                                        *
*   60        23.0      3.40                                                                                                        *
*   61        24.0      1.67                                                                                                        *
*   62        25.0     -0.07                                                                                                        *
*   63        26.0     -1.03                                                                                                        *
*   64        27.0     -0.50                                                                                                        *
*   65        28.0      0.63                                                                                                        *
*   66        29.0      1.75                                                                                                        *
*   67        30.0      2.25                                                                                                        *
*   68        31.0      2.44                                                                                                        *
*   69        32.0      2.05                                                                                                        *
*   70        33.0      0.79                                                                                                        *
*   71        34.0     -0.64                                                                                                        *
*   72        35.0     -2.07                                                                                                        *
*   73        36.0     -3.50                                                                                                        *
*   74        37.0     -3.98                                                                                                        *
*   75        38.0     -3.57                                                                                                        *
*   76        39.0     -2.50                                                                                                        *
*   77        40.0     -0.83                                                                                                        *
*   78        41.0      0.83                                                                                                        *
*   79        42.0      2.50                                                                                                        *
*   80        43.0      3.50                                                                                                        *
*   81        44.0      4.00                                                                                                        *
*   82        45.0      4.10                                                                                                        *
*   83        46.0      3.90                                                                                                        *
*   84        47.0      3.50                                                                                                        *
*   85        48.0      2.27                                                                                                        *
*   86        49.0      0.81                                                                                                        *
*   87        50.0     -0.65                                                                                                        *
*   88        51.0     -0.95                                                                                                        *
*   89        52.0     -0.21                                                                                                        *
*                                                                                                                                   *
*************************************************************************************************************************************
```

INPUT

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************************************************ E N G D A T   F I L E   L I S T I N G ******************************************
*       NUMBER           FILE                                                                            RUN           PAGE       *
*       RECORDS          NAME                                                                            DATE          NO         *
*         572            [illegible]                                                                     10/16/84        3        *
***********************************************************************************************************************************
*                                                                                                          1         1         1    *
*                1         2         3         4         5         6         7         8         9         0         1         2    *
*       123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890    *
*
*    90       53.0      0.77
*    91       54.0      1.75
*    92       55.0      2.25
*    93       56.0      2.40
*    94       57.0      1.75
*    95       58.0      0.22
*    96       59.0     -1.49
*    97       60.0     -2.80
*    98       61.0     -3.35
*    99       62.0     -3.51
*   100       63.0     -3.48
*   101       64.0     -3.00
*   102       65.0     -2.15
*   103       66.0     -0.42
*   104       67.0      1.32
*   105       68.0      3.05
*   106       69.0      3.65
*   107       70.0      3.98
*   108       71.0      3.80
*   109       72.0      3.40
*   110       73.0      2.50
*   111       74.0      1.40
*   112       75.0      0.00
*   113 F4 TABLE =   78 POINTS
*   114       0.00        76                                                     F4-0001
*   115       0.50       147                                                     F4-0002
*   116       1.00       297                                                     F4-0003
*   117       1.50       583                                                     F4-0004
*   118       2.00       889                                                     F4-0005
*   119       2.50      1137                                                     F4-0006
*   120       3.        1436
*   121       3.5       1691
*   122       4.        2070
*   123       4.5       2523
*   124       5.        2900
*   125       5.5       3041
*   126       6.        3038
*   127       6.5       2980
*   128       7.        2922
*   129       7.5       2920
*   130       8.        2979
*   131       8.5       3037
*   132       9.        3069
*   133       9.5       3047
*
***********************************************************************************************************************************
```

INPUT

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******************************************** E N G D A T   F I L E   L I S T I N G ********************************************
*      NUMBER          FILE                                                                              RUN           PAGE        *
*      RECORDS         NAME                                                                              DATE          NO          *
*        572           IKJTK2                                                                          10/16/84         4          *
************************************************************************************************************************************
*                                                                                                                                  *
*                                                                                                          1         1         1    *
*                1         2         3         4         5         6         7         8         9         0         1         2    *
*       123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890    *
*                                                                                                                                  *
*  134       10.        2991                                                                                                        *
*  135       10.5       2948                                                                                                        *
*  136       11.        2934                                                                                                        *
*  137       11.5       2957                                                                                                        *
*  138       12.        3008                                                                                                        *
*  139       12.5       3064                                                                                                        *
*  140       13.        3172                                                                                                        *
*  141       13.5       3431                                                                                                        *
*  142       14.        3728                                                                                                        *
*  143       14.5       3800                                                                                                        *
*  144       15.        3760                                                                                                        *
*  145       15.5       3960                                                                                                        *
*  146       16.        4337                                                                                                        *
*  147       16.5       4603                                                                                                        *
*  148       17.        4930                                                                                                        *
*  149       17.5       5796                                                                                                        *
*  150       18.        6992                                                                                                        *
*  151       18.5       6741                                                                                                        *
*  152       19.        5344                                                                                                        *
*  153       19.5       4795                                                                                                        *
*  154       20.        4469                                                                                                        *
*  155       20.5       4085                                                                                                        *
*  156       21.        3856                                                                                                        *
*  157       21.5       3627                                                                                                        *
*  158       22.        3488                                                                                                        *
*  159       22.5       3388                                                                                                        *
*  160       23.00      3171                                                     F4-0047                                            *
*  161       23.50      3093                                                     F4-0048                                            *
*  162       24.00      2949                                                     F4-0049                                            *
*  163       24.50      2652                                                     F4-0050                                            *
*  164       25.00      2277                                                     F4-0051                                            *
*  165       25.50      2010                                                     F4-0052                                            *
*  166       26.00      1848                                                     F4-0053                                            *
*  167       26.50      1724                                                     F4-0054                                            *
*  168       27.00      1634                                                     F4-0055                                            *
*  169       27.50      1570                                                     F4-0056                                            *
*  170       28.00      1522                                                     F4-0057                                            *
*  171       28.50      1482                                                     F4-0058                                            *
*  172       29.00      1445                                                     F4-0059                                            *
*  173       29.50      1416                                                     F4-0060                                            *
*  174       30.00      1390                                                     F4-0061                                            *
*  175       30.50      1368                                                     F4-0062                                            *
*  176       31.00      1347                                                     F4-0063                                            *
*  177       31.50      1212                                                     [illegible]                                        *
*                                                                                                                                  *
************************************************************************************************************************************
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INPUT

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************************************ E N G D A T   F I L E   L I S T I N G ************************************
*        NUMBER          FILE                                                      RUN           PAGE        *
*        RECORDS         NAME                                                      DATE          NO          *
*          572           IKJTK2                                                    10/16/84        5         *
****************************************************************************************************************
*
*                                                                                                          1         1         1     *
*                1         2         3         4         5         6         7         8         9         0         1         2     *
*       123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890     *
*
*  178       32.00       910                                                     F4-0065                                           *
*  179       32.50       652                                                     F4-0066                                           *
*  180       33.00       369                                                     F4-0067                                           *
*  181       33.50       185                                                     F4-0068                                           *
*  182       34.00       113                                                     F4-0069                                           *
*  183       34.50        65                                                     F4-0070                                           *
*  184       35.00        34                                                     F4-0071                                           *
*  185       35.50        18                                                     F4-0072                                           *
*  186       36.00         9                                                     F4-0073                                           *
*  187       36.50         4                                                     F4-0074                                           *
*  188       37.00         2                                                     F4-0075                                           *
*  189       37.50         1                                                     F4-0076                                           *
*  190       38.00         1                                                     F4-0077                                           *
*  191       38.5          0                                                                                                       *
*  192  CALCULATE                                                                                                                  *
*  193  TITLE                                                                                                                      *
*  194  99WD             DISTRICT STUDY                                                                                            *
*  195  BSHIFT F2   1.0 HOUR                                                     BS-0000                                           *
*  196        1.00     -1.20                                                                                                       *
*  197  CALCULATE                                                                                                                  *
*  198  TITLE                                                                    TI-0000                                           *
*  199  99WD             DISTRICT STUDY                                                                                            *
*  200  BSHIFT F2   1.0 HOUR                                                     BS-0000                                           *
*  201        1.00     -1.07                                                                                                       *
*  202  CALCULATE                                                                                                                  *
*  203  TITLE                                                                    TI-0000                                           *
*  204  99WD             DISTRICT STUDY                                                                                            *
*  205  BSHIFT F2   1.0 HOUR                                                     BS-0000                                           *
*  206        1.00     -0.18                                                                                                       *
*  207  CALCULATE                                                                                                                  *
*  208  TITLE                                                                    TI-0000                                           *
*  209  99WD             DISTRICT STUDY                                                                                            *
*  210  BSHIFT F2   1.0 HOUR                                                     BS-0000                                           *
*  211        1.00      0.71                                                                                                       *
*  212  CALCULATE                                                                                                                  *
*  213  TITLE                                                                    TI-0000                                           *
*  214  99WD             DISTRICT STUDY                                                                                            *
*  215  BSHIFT F2   1.0 HOUR                                                     BS-0000                                           *
*  216        1.00      1.61                                                                                                       *
*  217  CALCULATE                                                                                                                  *
*  218  TITLE                                                                    TI-0000                                           *
*  219  99WD             DISTRICT STUDY                                                                                            *
*  220  BSHIFT F2   1.0 HOUR                                                     BS-0000                                           *
*  221        1.00      2.50                                                                                                       *
*                                                                                                                                  *
************************************************************************************************************************************
```

INPUT

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****************************************** E N G D A T   F I L E   L I S T I N G ******************************************************
*       NUMBER            FILE                                                                                      RUN                 PAGE          *
*       RECORDS           NAME                                                                                      DATE                NO            *
*        572              IKJTK2                                                                                    10/16/84             6            *
****************************************************************************************************************************************
*                                                                                                                      1         1         1          *
*                1         2         3         4         5         6         7         8         9         0         1         2          *
*       123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890          *
*                                                                                                                                                      *
*  222  CALCULATE                                                                                                                                      *
*  223  TITLE                                                                          TI=0000                                                         *
*  224  99WD               DISTRICT STUDY                                                                                                              *
*  225  BSHIFT F2    1.0 HOUR                                                          BS=0000                                                         *
*  226         1.00       2.75                                                                                                                         *
*  227  CALCULATE                                                                                                                                      *
*  228  TITLE                                                                          TI=0000                                                         *
*  229  99WD               DISTRICT STUDY                                                                                                              *
*  230  BSHIFT F2    1.0 HOUR                                                          BS=0000                                                         *
*  231         1.00       2.35                                                                                                                         *
*  232  CALCULATE                                                                                                                                      *
*  233  TITLE                                                                          TI=0000                                                         *
*  234  99WD               DISTRICT STUDY                                                                                                              *
*  235  BSHIFT F2    1.0 HOUR                                                          BS=0000                                                         *
*  236         1.00       0.86                                                                                                                         *
*  237  CALCULATE                                                                                                                                      *
*  238  TITLE                                                                          TI=0000                                                         *
*  239  99WD               DISTRICT STUDY                                                                                                              *
*  240  BSHIFT F2    1.0 HOUR                                                          BS=0000                                                         *
*  241         1.00      -0.63                                                                                                                         *
*  242  CALCULATE                                                                                                                                      *
*  243  TITLE                                                                          TI=0000                                                         *
*  244  99WD               DISTRICT STUDY                                                                                                              *
*  245  BSHIFT F2    1.0 HOUR                                                          BS=0000                                                         *
*  246         1.00      -2.11                                                                                                                         *
*  247  CALCULATE                                                                                                                                      *
*  248  TITLE                                                                          TI=0000                                                         *
*  249  99WD               DISTRICT STUDY                                                                                                              *
*  250  BSHIFT F2    1.0 HOUR                                                          BS=0000                                                         *
*  251         1.00      -3.60                                                                                                                         *
*  252  CALCULATE                                                                                                                                      *
*  253  TITLE                                                                          TI=0000                                                         *
*  254  99WD               DISTRICT STUDY                                                                                                              *
*  255  BSHIFT F2    1.0 HOUR                                                          BS=0000                                                         *
*  256         1.00      -3.84                                                                                                                         *
*  257  CALCULATE                                                                                                                                      *
*  258  TITLE                                                                          TI=0000                                                         *
*  259  99WD               DISTRICT STUDY                                                                                                              *
*  260  BSHIFT F2    1.0 HOUR                                                          BS=0000                                                         *
*  261         1.00      -3.50                                                                                                                         *
*  262  CALCULATE                                                                                                                                      *
*  263  TITLE                                                                          TI=0000                                                         *
*  264  99WD               DISTRICT STUDY                                                                                                              *
*  265  BSHIFT F2    1.0 HOUR                                                          BS=0000                                                         *
*                                                                                                                                                      *
****************************************************************************************************************************************
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INPUT

```
**************************************** E N G D A T   F I L E   L I S T I N G *************************************************
*        NUMBER              FILE                                                                          RUN             PAGE          *
*        RECORDS             NAME                                                                          DATE            NO            *
*          572               IKJIK2                                                                        10/16/84          7           *
******************************************************************************************************************************************
*                                                                                                            1               1               1   *
*                      1            2            3            4            5            6            7            8            9            0               1               2   *
*         123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890    *
*                                                                                                                                        *
*   266          1.00       -1.90                                                                                                        *
*   267   CALCULATE                                                                                                                      *
*   268   TITLE                                                                               TI-0000                                    *
*   269   99WD                DISTRICT STUDY                                                                                             *
*   270   BSHIFT F2     1.0 HOUR                                                              BS-0000                                    *
*   271          1.00       -0.30                                                                                                        *
*   272   CALCULATE                                                                                                                      *
*   273   TITLE                                                                                                                          *
*   274   99WD                DISTRICT STUDY                                                                                             *
*   275   BSHIFT F2     1.0 HOUR                                                              BS-0000                                    *
*   276          1.00        1.30                                                                                                        *
*   277   CALCULATE                                                                                                                      *
*   278   TITLE                                                                               TI-0000                                    *
*   279   99WD                DISTRICT STUDY                                                                                             *
*   280   BSHIFT F2     1.0 HOUR                                                              BS-0000                                    *
*   281          1.00        2.90                                                                                                        *
*   282   CALCULATE                                                                                                                      *
*   283   TITLE                                                                               TI-0000                                    *
*   284   99WD                DISTRICT STUDY                                                                                             *
*   285   BSHIFT F2     1.0 HOUR                                                              BS-0000                                    *
*   286          1.00        4.10                                                                                                        *
*   287   CALCULATE                                                                                                                      *
*   288   TITLE                                                                               TI-0000                                    *
*   289   99WD                DISTRICT STUDY                                                                                             *
*   290   BSHIFT F2     1.0 HOUR                                                              BS-0000                                    *
*   291          1.00        4.55                                                                                                        *
*   292   CALCULATE                                                                                                                      *
*   293   TITLE                                                                               TI-0000                                    *
*   294   99WD                DISTRICT STUDY                                                                                             *
*   295   BSHIFT F2     1.0 HOUR                                                              BS-0000                                    *
*   296          1.00        4.58                                                                                                        *
*   297   CALCULATE                                                                                                                      *
*   298   TITLE                                                                               TI-0000                                    *
*   299   99WD                DISTRICT STUDY                                                                                             *
*   300   BSHIFT F2     1.0 HOUR                                                              BS-0000                                    *
*   301          1.00        4.30                                                                                                        *
*   302   CALCULATE                                                                                                                      *
*   303   TITLE                                                                               TI-0000                                    *
*   304   99WD                DISTRICT STUDY                                                                                             *
*   305   BSHIFT F2     1.0 HOUR                                                              BS-0000                                    *
*   306          1.00        3.40                                                                                                        *
*   307   CALCULATE                                                                                                                      *
*   308   TITLE                                                                               TI-0000                                    *
*   309   99WD                DISTRICT STUDY                                                                                             *
*                                                                                                                                        *
******************************************************************************************************************************************
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INPUT

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***************************************** E N G D A T   F I L E   L I S T I N G ******************************************
*      NUMBER          FILE                                                                       RUN           PAGE       *
*      RECORDS         NAME                                                                       DATE          NO         *
*       572            IKJTK2                                                                     10/16/84       8         *
****************************************************************************************************************************
*                                                                                                  1        1        1     *
*                1         2         3         4         5         6         7         8         9         0         1         2     *
*     123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890 *
*                                                                                                                          *
*  310  BSHIFT F2    1.0 HOUR                                                   BS=0000                                    *
*  311         1.00        1.67                                                                                            *
*  312  CALCULATE                                                                                                          *
*  313  TITLE                                                                   TI=0000                                    *
*  314  99WD                DISTRICT STUDY                                                                                 *
*  315  BSHIFT F2    1.0 HOUR                                                   BS=0000                                    *
*  316         1.00       -0.07                                                                                            *
*  317  CALCULATE                                                                                                          *
*  318  TITLE                                                                   TI=0000                                    *
*  319  99WD                DISTRICT STUDY                                                                                 *
*  320  BSHIFT F2    1.0 HOUR                                                   BS=0000                                    *
*  321         1.00       -1.03                                                                                            *
*  322  CALCULATE                                                                                                          *
*  323  TITLE                                                                   TI=0000                                    *
*  324  99WD                DISTRICT STUDY                                                                                 *
*  325  BSHIFT F2    1.0 HOUR                                                   BS=0000                                    *
*  326         1.00       -0.50                                                                                            *
*  327  CALCULATE                                                                                                          *
*  328  TITLE                                                                   TI=0000                                    *
*  329  99WD                DISTRICT STUDY                                                                                 *
*  330  BSHIFT F2    1.0 HOUR                                                   BS=0000                                    *
*  331         1.00        0.63                                                                                            *
*  332  CALCULATE                                                                                                          *
*  333  TITLE                                                                   TI=0000                                    *
*  334  99WD                DISTRICT STUDY                                                                                 *
*  335  BSHIFT F2    1.0 HOUR                                                                                              *
*  336         1.0         1.19                                                                                            *
*  337  CALCULATE                                                                                                          *
*  338  TITLE                                                                   TI=0000                                    *
*  339  99WD                DISTRICT STUDY                                                                                 *
*  340  BSHIFT F2    1.0 HOUR                                                   BS=0000                                    *
*  341         1.00        1.75                                                                                            *
*  342  CALCULATE                                                                                                          *
*  343  TITLE                                                                   TI=0000                                    *
*  344  99WD                DISTRICT STUDY                                                                                 *
*  345  BSHIFT F2    1.0 HOUR                                                   BS=0000                                    *
*  346         1.00        2.25                                                                                            *
*  347  CALCULATE                                                                                                          *
*  348  TITLE                                                                   TI=0000                                    *
*  349  99WD                DISTRICT STUDY                                                                                 *
*  350  BSHIFT F2    1.0 HOUR                                                   BS=0000                                    *
*  351         1.00        2.44                                                                                            *
*  352  CALCULATE                                                                                                          *
*  353  TITLE                                                                   TI=0000                                    *
*                                                                                                                          *
****************************************************************************************************************************
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INPUT

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******************************************** E N G D A T   F I L E   L I S T I N G ************************************************
*        NUMBER              FILE                                                                          RUN             PAGE        *
*        RECORDS             NAME                                                                          DATE            NO          *
*          572               [illegible]                                                                   10/16/84          9         *
***************************************************************************************************************************************
*                                                                                                                                      *
*                                                                                                         1         1         1        *
*                    1         2         3         4         5         6         7         8         9         0         1         2        *
*              123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890 *
*                                                                                                                                      *
*     354      99WD             DISTRICT STUDY                                                                                         *
*     355      BSHIFT F2   1.0 HOUR                                                 BS-0000                                            *
*     356            1.00       2.05                                                                                                   *
*     357      CALCULATE                                                                                                               *
*     358      TITLE                                                                TI-0000                                            *
*     359      99WD             DISTRICT STUDY                                                                                         *
*     360      BSHIFT F2   1.0 HOUR                                                 BS-0000                                            *
*     361            1.00       0.79                                                                                                   *
*     362      CALCULATE                                                                                                               *
*     363      TITLE                                                                TI-0000                                            *
*     364      99WD             DISTRICT STUDY                                                                                         *
*     365      BSHIFT F2   1.0 HOUR                                                 BS-0000                                            *
*     366            1.00      -0.64                                                                                                   *
*     367      CALCULATE                                                                                                               *
*     368      TITLE                                                                TI-0000                                            *
*     369      99WD             DISTRICT STUDY                                                                                         *
*     370      BSHIFT F2   1.0 HOUR                                                 BS-0000                                            *
*     371            1.00      -2.07                                                                                                   *
*     372      CALCULATE                                                                                                               *
*     373      TITLE                                                                TI-0000                                            *
*     374      99WD             DISTRICT STUDY                                                                                         *
*     375      BSHIFT F2   1.0 HOUR                                                 BS-0000                                            *
*     376            1.00      -3.50                                                                                                   *
*     377      CALCULATE                                                                                                               *
*     378      TITLE                                                                TI-0000                                            *
*     379      99WD             DISTRICT STUDY                                                                                         *
*     380      BSHIFT F2   1.0 HOUR                                                 BS-0000                                            *
*     381            1.00      -3.98                                                                                                   *
*     382      CALCULATE                                                                                                               *
*     383      TITLE                                                                TI-0000                                            *
*     384      99WD             DISTRICT STUDY                                                                                         *
*     385      BSHIFT F2   1.0 HOUR                                                 BS-0000                                            *
*     386            1.00      -3.57                                                                                                   *
*     387      CALCULATE                                                                                                               *
*     388      TITLE                                                                TI-0000                                            *
*     389      99WD             DISTRICT STUDY                                                                                         *
*     390      BSHIFT F2   1.0 HOUR                                                 BS-0000                                            *
*     391            1.00      -2.50                                                                                                   *
*     392      CALCULATE                                                                                                               *
*     393      TITLE                                                                TI-0000                                            *
*     394      99WD             DISTRICT STUDY                                                                                         *
*     395      BSHIFT F2   1.0 HOUR                                                 BS-0000                                            *
*     396            1.00      -0.83                                                                                                   *
*     397      CALCULATE                                                                                                               *
*                                                                                                                                      *
***************************************************************************************************************************************
```

INPUT

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*********************************************************** E N G D A T  F I L E  L I S T I N G *****************************************************
*     NUMBER           FILE                                                                                               RUN         PAGE          *
*     RECORDS          NAME                                                                                               DATE        NO            *
*       572            IKJTK2                                                                                             10/16/84     10           *
*****************************************************************************************************************************************************
*                                                                                                                                                    *
*                                                                                                               1         1         1               *
*                 1         2         3         4         5         6         7         8         9         0         1         2               *
*        123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890               *
*                                                                                                                                                    *
*  398   TITLE                                                                    TI=0000                                                           *
*  399   99WD             DISTRICT STUDY                                                                                                            *
*  400   BSHIFT F2   1.0 HOUR                                                     BS=0000                                                           *
*  401         1.00      0.83                                                                                                                       *
*  402   CALCULATE                                                                                                                                  *
*  403   TITLE                                                                    TI=0000                                                           *
*  404   99WD             DISTRICT STUDY                                                                                                            *
*  405   BSHIFT F2   1.0 HOUR                                                     BS=0000                                                           *
*  406         1.00      2.50                                                                                                                       *
*  407   CALCULATE                                                                                                                                  *
*  408   TITLE                                                                    TI=0000                                                           *
*  409   99WD             DISTRICT STUDY                                                                                                            *
*  410   BSHIFT F2   1.0 HOUR                                                     BS=0000                                                           *
*  411         1.00      3.50                                                                                                                       *
*  412   CALCULATE                                                                                                                                  *
*  413   TITLE                                                                    TI=0000                                                           *
*  414   99WD             DISTRICT STUDY                                                                                                            *
*  415   BSHIFT F2   1.0 HOUR                                                     BS=0000                                                           *
*  416         1.00      4.00                                                                                                                       *
*  417   CALCULATE                                                                                                                                  *
*  418   TITLE                                                                    TI=0000                                                           *
*  419   99WD             DISTRICT STUDY                                                                                                            *
*  420   BSHIFT F2   1.0 HOUR                                                     BS=0000                                                           *
*  421         1.00      4.10                                                                                                                       *
*  422   CALCULATE                                                                                                                                  *
*  423   TITLE                                                                    TI=0000                                                           *
*  424   99WD             DISTRICT STUDY                                                                                                            *
*  425   BSHIFT F2   1.0 HOUR                                                     BS=0000                                                           *
*  426         1.00      3.90                                                                                                                       *
*  427   CALCULATE                                                                                                                                  *
*  428   TITLE                                                                    TI=0000                                                           *
*  429   99WD             DISTRICT STUDY                                                                                                            *
*  430   BSHIFT F2   1.0 HOUR                                                     BS=0000                                                           *
*  431         1.00      3.50                                                                                                                       *
*  432   CALCULATE                                                                                                                                  *
*  433   TITLE                                                                    TI=0000                                                           *
*  434   99WD             DISTRICT STUDY                                                                                                            *
*  435   BSHIFT F2   1.0 HOUR                                                     BS=0000                                                           *
*  436         1.00      2.27                                                                                                                       *
*  437   CALCULATE                                                                                                                                  *
*  438   TITLE                                                                    TI=0000                                                           *
*  439   99WD             DISTRICT STUDY                                                                                                            *
*  440   BSHIFT F2   1.0 HOUR                                                     BS=0000                                                           *
*  441         1.00      0.81                                                                                                                       *
*                                                                                                                                                    *
*****************************************************************************************************************************************************
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INPUT

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*********************************** E N G D A T   F I L E   L I S T I N G *************************************************
*     NUMBER        FILE                                                                               RUN         PAGE
*     RECORDS       NAME                                                                               DATE        NO
*       572         IKJIF2                                                                             10/16/84     11
****************************************************************************************************************************
*                                                                                                            1         1         1
*                 1         2         3         4         5         6         7         8         9         0         1         2
*        123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
*
*   442  CALCULATE
*   443  TITLE                                                                    TI-0000
*   444  99WD             DISTRICT STUDY
*   445  BSHIFT F2   1.0 HOUR                                                     BS-0000
*   446        1.00     -0.65
*   447  CALCULATE
*   448  TITLE                                                                    TI-0000
*   449  99WD             DISTRICT STUDY
*   450  BSHIFT F2   1.0 HOUR                                                     BS-0000
*   451        1.00     -0.95
*   452  CALCULATE
*   453  TITLE                                                                    TI-0000
*   454  99WD             DISTRICT STUDY
*   455  BSHIFT F2   1.0 HOUR                                                     BS-0000
*   456        1.00     -0.21
*   457  CALCULATE
*   458  TITLE                                                                    TI-0000
*   459  99WD             DISTRICT STUDY
*   460  BSHIFT F2   1.0 HOUR                                                     BS-0000
*   461        1.00      0.77
*   462  CALCULATE
*   463  TITLE                                                                    TI-0000
*   464  99WD             DISTRICT STUDY
*   465  BSHIFT F2   1.0 HOUR                                                     BS-0000
*   466        1.00      1.75
*   467  CALCULATE
*   468  TITLE                                                                    TI-0000
*   469  99WD             DISTRICT STUDY
*   470  BSHIFT F2   1.0 HOUR                                                     BS-0000
*   471        1.00      2.25
*   472  CALCULATE
*   473  TITLE                                                                    TI-0000
*   474  99WD             DISTRICT STUDY
*   475  BSHIFT F2   1.0 HOUR                                                     BS-0000
*   476        1.00      2.40
*   477  CALCULATE
*   478  TITLE                                                                    TI-0000
*   479  99WD             DISTRICT STUDY
*   480  BSHIFT F2   1.0 HOUR                                                     BS-0000
*   481        1.00      1.75
*   482  CALCULATE
*   483  TITLE                                                                    TI-0000
*   484  99WD             DISTRICT STUDY
*   485  BSHIFT F2   1.0 HOUR                                                     BS-0000
*
****************************************************************************************************************************
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INPUT

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************************************ E N G D A T  F I L E  L I S T I N G ****************************************************
*        NUMBER            FILE                                                                RUN           PAGE          *
*        RECORDS           NAME                                                                DATE          NO            *
*          572             TKJTK2                                                              10/16/84       12           *
****************************************************************************************************************************
*                                                                                                   1         1         1  *
*                  1         2         3         4         5         6         7         8         9         0         1         2  *
*        123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890  *
*                                                                                                                          *
*   486          1.00       0.22                                                                                           *
*   487   CALCULATE                                                                                                        *
*   488   TITLE                                                          TI=0000                                           *
*   489   99WD                  DISTRICT STUDY                                                                             *
*   490   BSHIFT F2     1.0 HOUR                                         BS=0000                                           *
*   491          1.00      -1.49                                                                                           *
*   492   CALCULATE                                                                                                        *
*   493   TITLE                                                          TI=0000                                           *
*   494   99WD                  DISTRICT STUDY                                                                             *
*   495   BSHIFT F2     1.0 HOUR                                         BS=0000                                           *
*   496          1.00      -2.80                                                                                           *
*   497   CALCULATE                                                                                                        *
*   498   TITLE                                                          TI=0000                                           *
*   499   99WD                  DISTRICT STUDY                                                                             *
*   500   BSHIFT F2     1 HOUR                                                                                             *
*   501          1.00      -3.35                                                                                           *
*   502   CALCULATE                                                                                                        *
*   503   TITLE                                                          TI=0000                                           *
*   504   99WD                  DISTRICT STUDY                                                                             *
*   505   BSHIFT F2     1 HOUR                                                                                             *
*   506          1.00      -3.51                                                                                           *
*   507   CALCULATE                                                                                                        *
*   508   TITLE                                                          TI=0000                                           *
*   509   99WD                  DISTRICT STUDY                                                                             *
*   510   BSHIFT F2     1 HOUR                                                                                             *
*   511          1.00      -3.48                                                                                           *
*   512   CALCULATE                                                                                                        *
*   513   TITLE                                                          TI=0000                                           *
*   514   99WD                  DISTRICT STUDY                                                                             *
*   515   BSHIFT F2     1 HOUR                                                                                             *
*   516          1.00      -3.00                                                                                           *
*   517   CALCULATE                                                                                                        *
*   518   TITLE                                                          TI=0000                                           *
*   519   99WD                  DISTRICT STUDY                                                                             *
*   520   BSHIFT F2     1.0 HOURS                                                                                          *
*   521          1.00      -2.15                                                                                           *
*   522   CALCULATE                                                                                                        *
*   523   TITLE                                                          TI=0000                                           *
*   524   99WD                  DISTRICT STUDY                                                                             *
*   525   BSHIFT F2     1.0 HOURS                                                                                          *
*   526          1.00      -0.42                                                                                           *
*   527   CALCULATE                                                                                                        *
*   528   TITLE                                                          TI=0000                                           *
*   529   99WD                  DISTRICT STUDY                                                                             *
*                                                                                                                          *
****************************************************************************************************************************
```

INPUT

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************************************************************* E N G D A T   F I L E   L I S T I N G ***************************************************
*       NUMBER           FILE                                                                             RUN          PAGE
*       RECORDS          NAME                                                                             DATE         NO
*        572             IKJTK2                                                                          10/16/84       13
*********************************************************************************************************************************************************
*                                                                                                                 1         1         1
*                1         2         3         4         5         6         7         8         9         0         1         2
*       123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
*
*   530  BSHIFT F2   1.0 HOURS
*   531        1.00      1.32
*   532  CALCULATE
*   533  TITLE                                                                    TI=0000
*   534  99WD             DISTRICT STUDY
*   535  BSHIFT F2   1.0 HOURS
*   536        1.00      3.05
*   537  CALCULATE
*   538  TITLE                                                                    TI=0000
*   539  99WD             DISTRICT STUDY
*   540  BSHIFT F2   1.0 HOURS
*   541        1.00      3.65
*   542  CALCULATE
*   543  TITLE                                                                    TI=0000
*   544  99WD             DISTRICT STUDY
*   545  BSHIFT F2   1.0 HOURS
*   546        1.00      3.98
*   547  CALCULATE
*   548  TITLE                                                                    TI=0000
*   549  99WD             DISTRICT STUDY
*   550  BSHIFT F2   1.0 HOURS
*   551        1.00      3.80
*   552  CALCULATE
*   553  TITLE                                                                    TI=0000
*   554  99WD             DISTRICT STUDY
*   555  BSHIFT F2   1.0 HOURS
*   556        1.00      3.40
*   557  CALCULATE
*   558  TITLE                                                                    TI=0000
*   559  99WD             DISTRICT STUDY
*   560  BSHIFT F2   1.0 HOURS
*   561        1.00      2.50
*   562  CALCULATE
*   563  99WD             DISTRICT STUDY
*   564  BSHIFT F2   1.0 HOURS
*   565        1.00      1.40
*   566  CALCULATE
*   567  TITLE                                                                    TI=0000
*   568  99WD             DISTRICT STUDY
*   569  BSHIFT F2   1.0 HOURS
*   570        1.00      0.00
*   571  CALCULATE
*   572  ENDJOB
*
*
*********************************************************************************************************************************************************
```

OUTPUT

```
PALO ALTO FLOOD CONTROL BASIN MATH. MODEL - STUDY NO. ..WD

        STORAGE  S  (ACRE-FT)          BASIN ELEVATION  EB  (FT)

                  15.00                         -4.80
                  50.00                         -4.30
                  70.00                         -4.00
                 100.00                         -3.50
                 160.00                         -3.00
                 230.00                         -2.50
                 290.00                         -2.00
                 355.00                         -1.70
                 450.00                         -1.40
                 625.00                         -1.00
                 880.00                         -0.50
                1140.00                          0.00
                1410.00                          0.50
                1655.00                          1.00
                1935.00                          1.50
                2220.00                          2.00
                2475.00                          2.50
                2755.00                          3.00
                3025.00                          3.50
                3265.00                          4.00
                3545.00                          4.50
                3800.00                          5.00
                4095.00                          5.50
                4350.00                          6.00
                4635.00                          6.50
                5000.00                          7.00
```

```
PALO  ALTO  FLOOD  CONTROL  BASIN  MATH.  MODEL  -  STUDY  NO. ..WD

              TIME T (HOURS)              TIDAL ELEVATION ET (FT)

                    0.00                        0.00
                    1.00                       -1.20
                    2.00                       -1.07
                    3.00                       -0.18
                    4.00                        0.71
                    5.00                        1.61
                    6.00                        2.50
                    7.00                        2.75
                    8.00                        2.35
                    9.00                        0.86
                   10.00                       -0.63
                   11.00                       -2.11
                   12.00                       -3.60
                   13.00                       -3.84
                   14.00                       -3.50
                   15.00                       -1.90
                   16.00                       -0.30
                   17.00                        1.30
                   18.00                        2.90
                   19.00                        4.10
                   20.00                        4.55
                   21.00                        4.58
                   22.00                        4.30
                   23.00                        3.40
                   24.00                        1.67
                   25.00                       -0.07
                   26.00                       -1.03
                   27.00                       -0.50
                   28.00                        0.63
                   29.00                        1.75
                   30.00                        2.25
                   31.00                        2.44
                   32.00                        2.05
                   33.00                        0.79
                   34.00                       -0.64
                   35.00                       -2.07
                   36.00                       -3.50
                   37.00                       -3.98
                   38.00                       -3.57
                   39.00                       -2.50
                   40.00                       -0.83
                   41.00                        0.83
                   42.00                        2.50
                   43.00                        3.50
                   44.00                        4.00
                   45.00                        4.10
                   46.00                        3.90
                   47.00                        3.50
                   48.00                        2.27
                   49.00                        0.81
```

OUTPUT

OUTPUT

```
PALO  ALTO  FLOOD  CONTROL  BASIN  MATH. MODEL  -  STUDY  NO. ..WD

      TIME  T  (HOURS)               TIDAL ELEVATION  ET  (FT)

            50.00                          -0.65
            51.00                          -0.95
            52.00                          -0.21
            53.00                           0.77
            54.00                           1.75
            55.00                           2.25
            56.00                           2.40
            57.00                           1.75
            58.00                           0.22
            59.00                          -1.49
            60.00                          -2.80
            61.00                          -3.35
            62.00                          -3.51
            63.00                          -3.48
            64.00                          -3.00
            65.00                          -2.15
            66.00                          -0.42
            67.00                           1.32
            68.00                           3.05
            69.00                           3.65
            70.00                           3.98
            71.00                           3.80
            72.00                           3.40
            73.00                           2.50
            74.00                           1.40
            75.00                           0.00
            76.00                          -1.20
            77.00                          -1.07
            78.00                          -0.18
            79.00                           0.71
            80.00                           1.61
            81.00                           2.50
            82.00                           2.75
            83.00                           2.35
            84.00                           0.86
            85.00                          -0.63
            86.00                          -2.11
            87.00                          -3.60
            88.00                          -3.84
            89.00                          -3.50
            90.00                          -1.90
            91.00                          -0.30
            92.00                           1.30
            93.00                           2.90
            94.00                           4.10
            95.00                           4.55
            96.00                           4.58
            97.00                           4.30
            98.00                           3.40
            99.00                           1.67
```

```
PALO ALTO FLOOD CONTROL BASIN MATH. MODEL - STUDY NO. ..WD

        TIME T (HOURS)                  TIDAL ELEVATION ET (FT)

            100.00                              -0.07
            101.00                              -1.03
            102.00                              -0.50
            103.00                               0.63
            104.00                               1.75
            105.00                               2.25
            106.00                               2.44
            107.00                               2.05
            108.00                               0.79
            109.00                              -0.64
            110.00                              -2.07
            111.00                              -3.50
            112.00                              -3.98
            113.00                              -3.57
            114.00                              -2.50
            115.00                              -0.83
            116.00                               0.83
            117.00                               2.50
            118.00                               3.50
            119.00                               4.00
            120.00                               4.10
            121.00                               3.90
            122.00                               3.50
            123.00                               2.27
            124.00                               0.81
            125.00                              -0.65
            126.00                              -0.95
            127.00                              -0.21
            128.00                               0.77
            129.00                               1.75
            130.00                               2.25
            131.00                               2.40
            132.00                               1.75
            133.00                               0.22
            134.00                              -1.49
            135.00                              -2.80
            136.00                              -3.35
            137.00                              -3.51
            138.00                              -3.48
            139.00                              -3.00
            140.00                              -2.15
            141.00                              -0.42
            142.00                               1.32
            143.00                               3.05
            144.00                               3.65
            145.00                               3.98
            146.00                               3.80
            147.00                               3.40
            148.00                               2.50
            149.00                               1.40
```

OUTPUT

OUTPUT

```
PALO ALTO FLOOD CONTROL BASIN MATH. MODEL - STUDY NO. ..WD

          TIME  T  (HOURS)                BASIN INFLOW RATE I (CFS)

                 0.00                              76.00
                 0.50                             147.00
                 1.00                             297.00
                 1.50                             583.00
                 2.00                             889.00
                 2.50                            1137.00
                 3.00                            1436.00
                 3.50                            1691.00
                 4.00                            2070.00
                 4.50                            2523.00
                 5.00                            2900.00
                 5.50                            3041.00
                 6.00                            3038.00
                 6.50                            2980.00
                 7.00                            2922.00
                 7.50                            2920.00
                 8.00                            2979.00
                 8.50                            3037.00
                 9.00                            3069.00
                 9.50                            3047.00
                10.00                            2991.00
                10.50                            2948.00
                11.00                            2934.00
                11.50                            2957.00
                12.00                            3008.00
                12.50                            3064.00
                13.00                            3172.00
                13.50                            3431.00
                14.00                            3728.00
                14.50                            3800.00
                15.00                            3760.00
                15.50                            3960.00
                16.00                            4337.00
                16.50                            4603.00
                17.00                            4930.00
                17.50                            5796.00
                18.00                            6992.00
                18.50                            6741.00
                19.00                            5344.00
                19.50                            4795.00
                20.00                            4469.00
                20.50                            4085.00
                21.00                            3856.00
                21.50                            3627.00
                22.00                            3488.00
                22.50                            3388.00
                23.00                            3171.00
                23.50                            3093.00
                24.00                            2949.00
                24.50                            2652.00
```

OUTPUT

```
PALO  ALTO  FLOOD  CONTROL  BASIN  MATH.  MODEL  -  STUDY  NO. ..WD

TIME  T  (HOURS)          BASIN INFLOW RATE I (CFS)
     25.00                      2277.00
     25.50                      2010.00
     26.00                      1848.00
     26.50                      1724.00
     27.00                      1634.00
     27.50                      1570.00
     28.00                      1522.00
     28.50                      1482.00
     29.00                      1445.00
     29.50                      1416.00
     30.00                      1390.00
     30.50                      1368.00
     31.00                      1347.00
     31.50                      1212.00
     32.00                       910.00
     32.50                       652.00
     33.00                       369.00
     33.50                       185.00
     34.00                       113.00
     34.50                        65.00
     35.00                        34.00
     35.50                        18.00
     36.00                         9.00
     36.50                         4.00
     37.00                         2.00
     37.50                         1.00
     38.00                         1.00
     38.50                         0.00
```

OUTPUT

```
PALO  ALTO  FLOOD  CONTROL  BASIN  MATH.  MODEL  -  STUDY  NO.  ..WD

 DELTA T     EPSILON      POT                          TMAX      TN        MAXIT
  0.10        0.01        1.0                          100.0     24.0       100

 TZERO       SZERO        SMIN                          CF1      CF2       NPAIR
  0.00       290.0       285.0                          2.90     4.01        8.
```

OUTPUT

```
               PALO  ALTO  FLOOD  CONTROL  BASIN  MATH.  MODEL  -  STUDY  NO. ..WD
                          WATER DISTRICT STUDY

    TIME  T       INFLOW  I       OUTFLOW  Q      STORAGE  S     BASIN ELEV. EB      TIDAL ELEV. FT
    (HRS)          (CFS)          CFS)          (ACRE-FT)          (FEET)              (FEET)

     0.00            76.            0.00           290.0             -2.00               0.00
     1.01           297.            0.00           303.8             -1.94              -1.20
     2.01           889.            0.00           352.4             -1.71              -1.07
     3.01          1436.            0.00           447.4             -1.41              -0.18
     4.01          2070.            0.00           589.7             -1.08               0.71
     5.01          2900.            0.00           796.6             -0.66               1.61
     6.01          3038.            0.00          1045.0             -0.18               2.50
     7.01          2922.            0.00          1291.3              0.28               2.75
     8.01          2979.            0.00          1533.9              0.75               2.35
     9.01          3069.          946.60          1772.0              1.21               0.86
    10.01          2991.         2287.53          1880.7              1.40              -0.63
    11.01          2934.         3024.14          1903.7              1.44              -2.11
    12.01          3008.         3095.72          1893.0              1.42              -3.60
    13.01          3172.         3094.63          1891.6              1.42              -3.84
    14.01          3728.         3115.21          1919.5              1.47              -3.50
    15.01          3760.         2987.05          1974.0              1.57              -1.90
    16.01          4337.         2304.00          2085.7              1.76              -0.30
    17.01          4930.         1499.16          2309.1              2.17               1.30
    18.01 ✓        6992.          248.22          2714.3 ✓            2.92 ✓             2.90
    19.01          5344.            0.00          3245.6              3.96               4.10
    20.01          4469.          546.29          3629.2              4.67               4.55
    21.01          3856.         1215.98          3890.9              5.15               4.58
    22.01          3488.         1724.99          4069.1              5.46               4.30
    23.01          3171.         2408.80          4173.8              5.66               3.40
    24.01          2949.         3217.52          4193.4             [5.69]              1.67
    25.01          2277.         3802.37          4119.7              5.55              -0.07
    26.01          1848.         4028.78          3964.2              5.28              -1.03
    27.01          1634.         3752.09          3785.7              4.97              -0.50
    28.01          1522.         3220.40          3627.3              4.66               0.63
    29.01          1445.         2627.32          3507.7              4.43               1.75
    30.01          1390.         2285.04          3421.6              4.28               2.25
    31.01          1347.         2102.23          3353.4              4.16               2.44
    32.01           910.         2245.32          3270.0              4.01               2.05
    33.01           369.         2732.12          3116.4              3.69               0.79
    34.01           113.         3163.65          2889.9              3.25              -0.64
    35.01            34.         3524.13          2618.9              2.76              -2.07
    36.01             9.         3409.18          2331.0              2.22              -3.50
    37.01             2.         3214.19          2057.9              1.72              -3.98
    38.01             1.         3025.98          1800.1              1.26              -3.57
    39.01             0.         3039.61          1536.4              0.76              -2.50
    40.01             0.         1786.40          1347.7              0.38              -0.83
    41.01             0.            0.00          1278.5              0.26               0.83
    42.01             0.            0.00          1278.5              0.26               2.50
    43.01             0.            0.00          1278.5              0.26               3.50
    44.01             0.            0.00          1278.5              0.26               4.00
    45.01             0.            0.00          1278.5              0.26               4.10
    46.01             0.            0.00          1278.5              0.26               3.90
    47.01             0.            0.00          1278.5              0.26               3.50
    48.01             0.            0.00          1278.5              0.26               2.27
    49.01             0.            0.00          1278.5              0.26               0.81
    50.01             0.         1459.13          1222.0              0.15              -0.65
```

OUTPUT

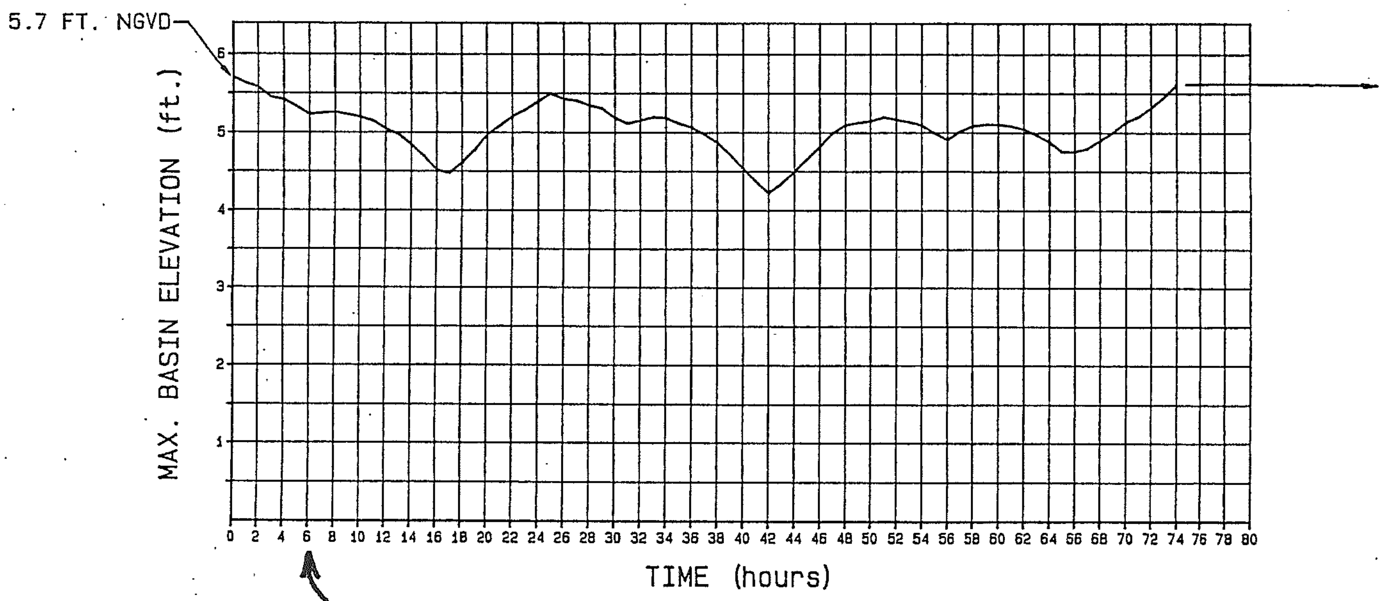
```
PALO  ALTO  FLOOD  CONTROL  BASIN  MATH.  MODEL  -  STUDY  NO. ..WD
           WATER DISTRICT STUDY

  TIME  T      INFLOW  I     OUTFLOW  Q     STORAGE  S     BASIN ELEV. EB     TIDAL ELEV. ET
  (HRS)         (CFS)          CFS)        (ACRE-FT)          (FEET)              (FEET)

  51.01          0.          1430.66        1102.5             -0.07               -0.95
  52.01          0.             0.00        1021.8             -0.23               -0.21
  53.01          0.             0.00        1021.8             -0.23                0.77
  54.01          0.             0.00        1021.8             -0.23                1.75
  55.01          0.             0.00        1021.8             -0.23                2.25
  56.01          0.             0.00        1021.8             -0.23                2.40
  57.01          0.             0.00        1021.8             -0.23                1.75
  58.01          0.             0.00        1021.8             -0.23                0.22
  59.01          0.          1461.71         954.3             -0.36               -1.49
  60.01          0.          1702.51         821.6             -0.61               -2.80
  61.01          0.          1783.15         673.3             -0.91               -3.35
  62.01          0.          1579.77         534.3             -1.21               -3.51
  63.01          0.          1377.50         411.8             -1.52               -3.48
  64.01          0.           907.72         319.7             -1.86               -3.00
  64.60          0.           586.29         282.0             -2.07               -2.49

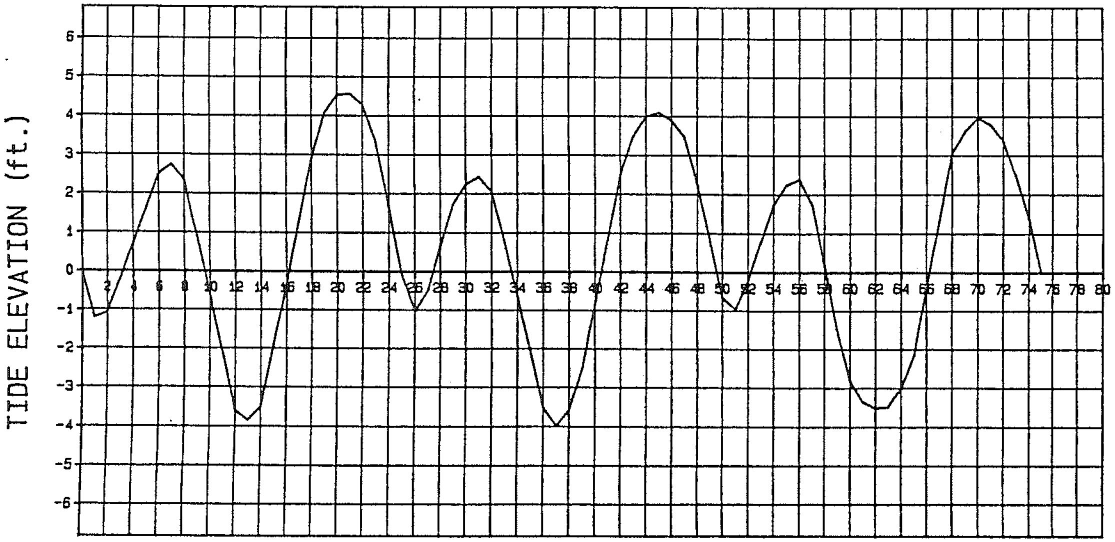
STORAGE IS NOW LESS THAN OR EQUAL TO ALLOWABLE MINIMUM, AFTER UPPER TIME LIMIT OF INTEGRATION
HAS BEEN REACHED - MODEL RUN IS CONSIDERED TO HAVE ARRIVED AT A SATISFACTORY CONCLUSION.
```

APPENDIX D
"TIDE SEQUENCES - ASSOCIATED BASIN ELEVATIONS"



C_{WEIR} = 2.90
$C_{ORIFICE}$ = 0.5
Q_{PEAK} = 6992 CFS
(DISTRICT'S INFLOW HYDROGRAPH)

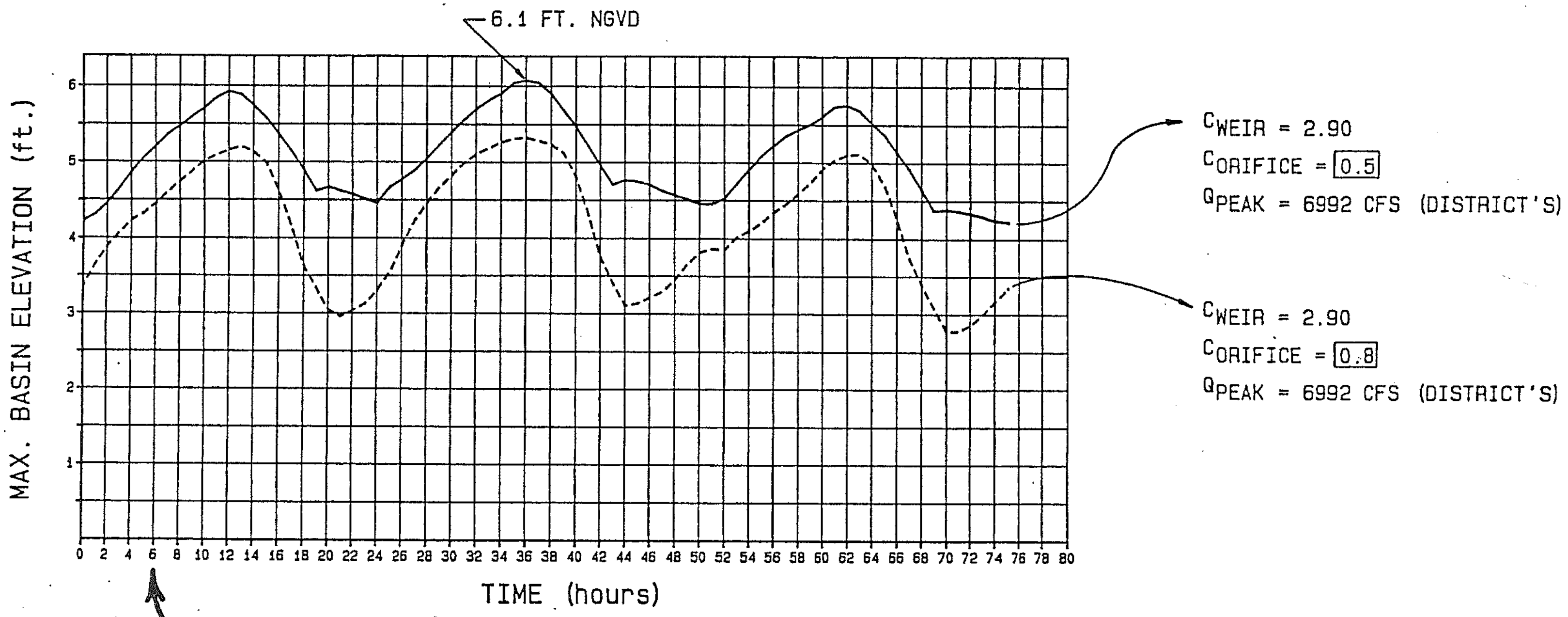
Example: If the inflow to the basin begins at the 6th hour, the tide at that hour will be 2.5' and the resulting maximum water surface in the basin will be 5.2', occuring at some later time.



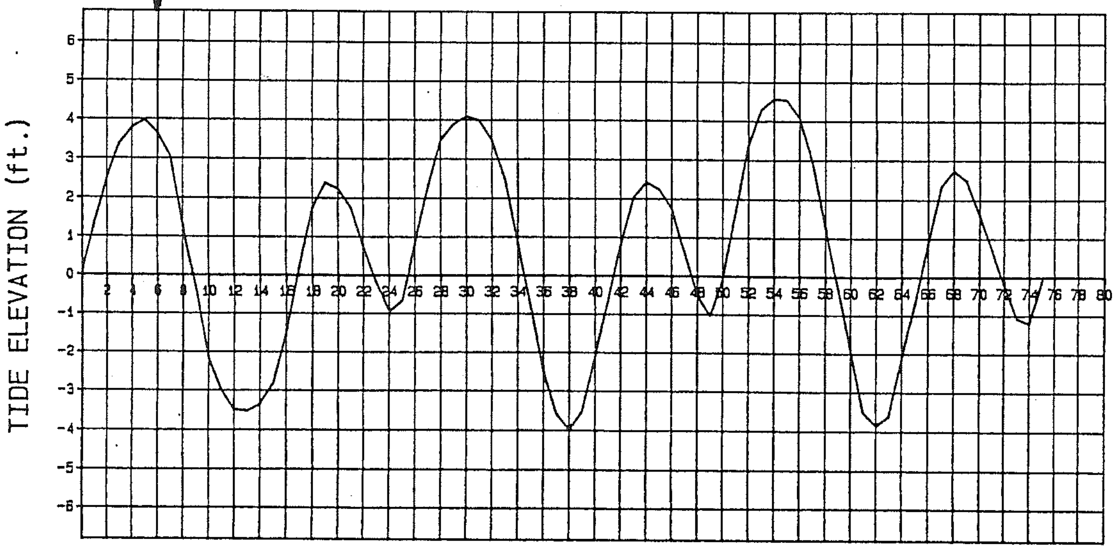
DECENDING TIDAL PATTERN
'TYPE 1' PATTERN

FIGURE A
DISTRICT'S TIDE CYCLE
AND BASIN ELEVATION

Santa Clara Valley Water District



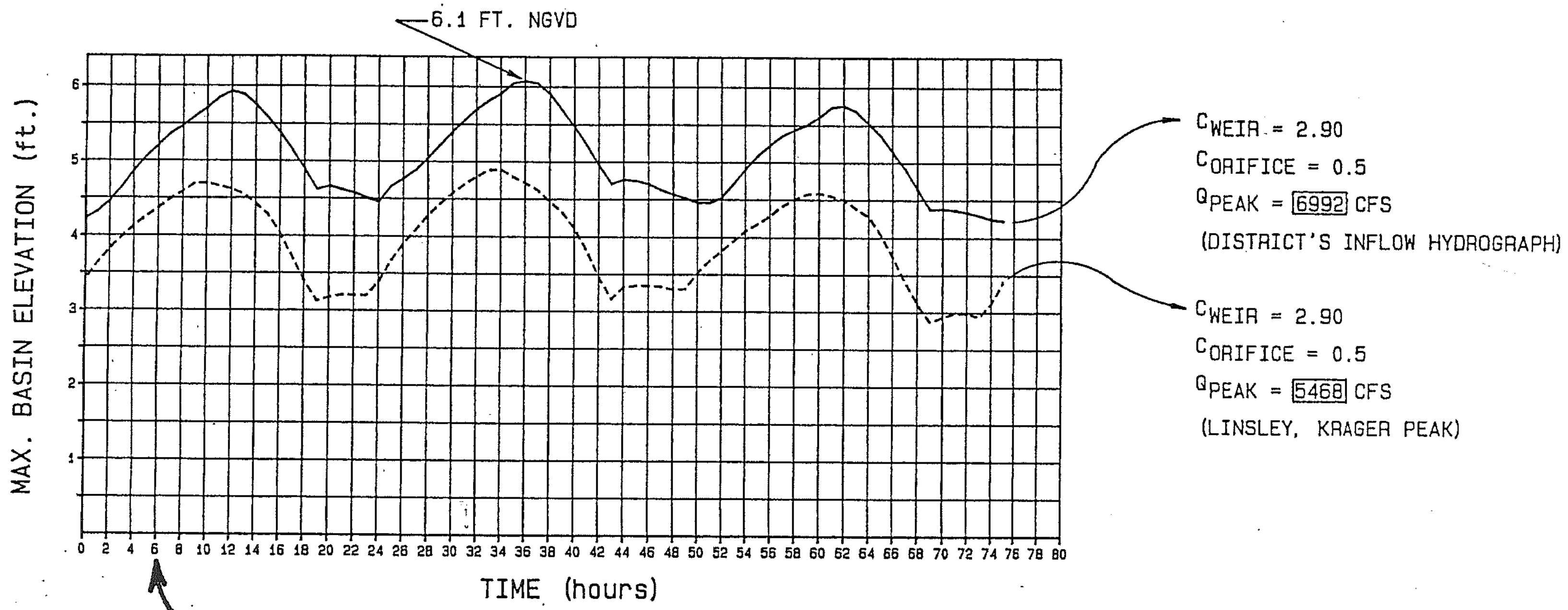
Example: If the inflow to the basin begins at the 6th hour, the tide at thathour will be 3.7' and the resulting maximum water surface in the basin will be either 5.2' or 4.5', occuring at some later time.



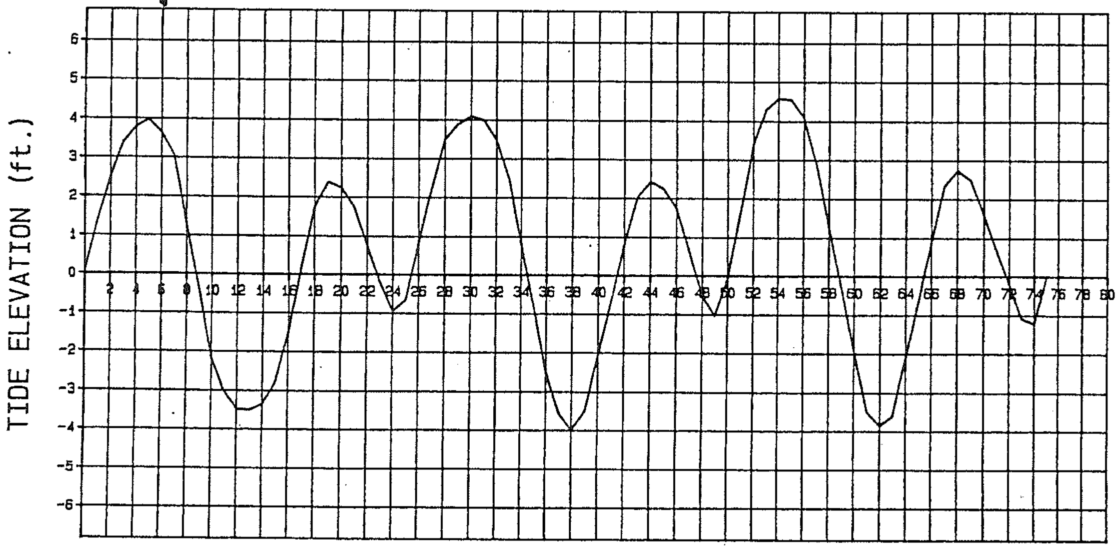
ASCENDING TIDAL SEQUENCE
'TYPE 2' PATTERN

FIGURE B
SENSITIVITY ANALYSIS-
ORIFICE COEFFICIENT

Santa Clara Valley Water District



Example: If the inflow to the basin begins at the 6th hour, the tide at that hour will be 3.7' and the resulting maximum water surface elevation in the basin will be either 5.2' or 4.4', occuring at some later time.



ASCENDING TIDAL SEQUENCE
'TYPE 2' PATTERN

FIGURE C
SENSITIVITY ANALYSIS-
INFLOW HYDROGRAPH

Santa Clara Valley Water District

APPENDIX E

"COMPUTATION OF ORIFICE DISCHARGE COEFFICIENT"

A method of computing a single discharge coefficient, C, from several loss coefficients, K, is documented in a Bureau of Reclamation publication entitled "Design of Small Dams". Chapter X of this book includes an example of how this computation is performed for the outlet works of a dam.

The loss coefficients may be associated with expansions, trash racks, flap gates, etc.

The computation consists of three parts:

1. Multiplying the loss coefficient by the area ratio for each element.

   Area ration = $(Ai/Ax)^2$

   Where: Ai = Area of conduit

   Ax = Area of element

2. Sum the products in Step 1 to obtain a total loss coefficient, K_L

3. Use the following equation:

$$C = \left(\frac{1}{K_L + 1}\right)^{1/2}$$

to solve for a single discharge coefficient.

The accuracy of the results is dependent upon the values of the loss coefficient used. Using the loss coefficients proposed by Linsley, a discharge coefficient, C, was computed. This coefficient varies with the flow rate because the loss coefficients vary also.

A value of C equal to 0.51 was computed for a depth of 7.5 feet above the invert, (see following pages).

SAMPLE COMPUTATION

Depth = 7.5' above invert
A_i = 25 sq. ft. x 16 gates = 400 sq. ft.

Element	K_L	A_x (sq. ft.)	$K_L\,(Ai/Ax)^2$
Trash Racks	1.03[1]	*358	1.29
Wing wall/inlet	0.6[2]	780	0.16
Entrance (soffit)	0	(no contraction @ 7.5')	0.0
	0		0.0
Gate Opening	0.6[2]	400	0.60
Flap Gate	.07[2] (V = 10 fps)	400	.07
Outlet Walls	0.80[2]	(5.5) (104) = 572.0	0.39
Wing wall/outlet	0.80[2]	(5.5)(113) = 621.5	0.33

K_L (Tot.) = 2.84

$$C = \sqrt{\frac{1}{K_{L(ta)=1}}} = \sqrt{\frac{1}{2.84+1}}$$

$$\boxed{C = 0.51}$$

1. Computation of K_L on next page.
2. Values obtained from King's "Handbook of Hydraulics".

---

* Assume 50% of opening blocked by algae/debris.

SAMPLE COMPUTATION
(continued)

Trash Racks - (Sample computation of minor loss, K_L).

$K_L = 1.45 - 0.45\ (An/Ag) - (An/Ag^2)^2$

A_n = Net area of flow = $Ag - A_{bars}$

$A_g = 104' \times (D)$ D = DEPTH (104' wide does not account for flow through the front face of the vertical supports)

A_{bars} = 52 bars/opening x (.25"/12') x D

A_{bars} = (1.08 x D) sq. ft. per opening.

Example

@ D = 7.5'

Ag = 780.0 sq. ft.

A_{bars} = 8.10 sq. ft. x 8 openings = 64.80 sq. ft.

A_n = 780.0 sq. ft. - 64.80 sq. ft. = 715.20 sq. ft.

Cut net area in half (debris & algae)

A_n = 357.60 sq. ft.

$K_L = 1.45 - 0.45\ (357.6/780) - (357.6/780)^2$

$\boxed{K_L = 1.03}$

APPENDIX F

"TABLE OF SENSITIVITY ANALYSIS"

File Name	Peak	Tide Sequence	Patt	Hydrograph Peak (cfs)	Discharge Coef. Weir	Orifice	Npair Gates	Basin Elevation Start	Max.	Ave.
IKTJK1	*4.6	Desc	LL-HH...	6992	2.90	0.5	8	-2.0	5.71	5.06
IKTJK2	4.6	Asc	HH-LL...	↓	↓	↓	↓	↓	6.08	5.09
IKTJK3	4.6	↓	↓	↓	↓	0.8	↓	↓	5.33	4.18
IKTJK4	4.6	↓	↓	↓	↓	0.5	16	↓	5.01	3.79
IKTJK5	4.6	↓	↓	↓	↓	0.8	↓	↓	4.75	3.48
IKTJK6	4.6	↓	↓	5500	↓	0.5	8	↓	4.90	3.95
IKTJK7	4.6	↓	↓	6992	2.55	0.8	↓	↓	5.33	4.19
IKTJK8	4.6	(Linsley, Kraeger)	↓	↓	↓	↓	↓	↓	5.22	4.09
IKLBK1	*4.6	Desc	LL-HH...	6293	2.90	0.5	8	-2.0	5.13	4.54
IKLBK2	*4.6	↓	↓	↓	↓	↓	↓	-1.0	5.33	-
IKLBK3	*4.6	↓	↓	↓	↓	↓	↓	0.0	5.43	-
IKJTK1	4.6	Desc	LL-HH...	6293	2.90	0.5	8	-2.0	5.18	4.53
IKJTK2	4.6	↓	↓	6992	↓	↓	↓	↓	$\boxed{5.69}$	5.06
IKTSK1	6.7	N/A	LL-HH...	6992	2.90	0.5	8	-2.0	6.26	5.56
IKSAK1	↓	↓	↓	6293 (-10%)	↓	↓	↓	-0.5	5.81	5.21
IKSAK2	↓	↓	↓	6642 (-5%)	↓	↓	↓	↓	6.14	5.50

---

*These tide cycles were not inputted on an hourly basis
Desc. - Descending
Asc. - Asending
Patt. - Pattern
N/A - Not Applicable